

NEW SERIES

**SELECTED
WATER
RESOURCES
ABSTRACTS**



**VOLUME 2, NUMBER 3
FEBRUARY 1, 1969**

NEW

SERIES

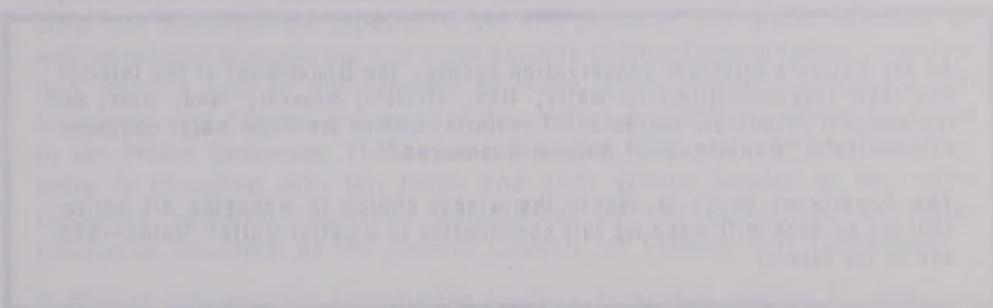
Selected Water Resources Abstracts is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the Clearinghouse for Federal Scientific and Technical Information (CFSTI) of the Bureau of Standards, U. S. Department of Commerce. It is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U. S. Department of the Interior, Washington, D. C. 20240. Annual subscription is \$22.00 (domestic), \$27.50 (foreign); single copy price is \$3.00.



SELECTED WATER RESOURCES ABSTRACTS

FEBRUARY

**'A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior**



Selected water resources abstracts are designed to keep you up-to-date on the latest developments in the field. The abstracts are selected from the scientific literature and are intended to help you quickly identify the most important research results.

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VOLUME 2, NUMBER 3
FEBRUARY 1, 1969

WR 69-00705 -- WR 69-01205

WATER POWER INDUSTRY

Water power is a renewable natural resource which will go on and on forever. It is a valuable asset to our country.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States--now and in the future.



U. S. DEPARTMENT OF THE
INTERIOR

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

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07 RESOURCES DATA

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10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions AND Suspensions

SOLUBILITY EQUILIBRIA INVOLVING METAL OXIDES AND CORRESPONDING AQUEOUS METAL PERCHLORATES,
North Carolina Univ., Chapel Hill, Chem Dept.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-00998

02. WATER CYCLE

2A. General

HYDROLOGICAL DATA AND PEAK DISCHARGE DETERMINATION OF SMALL HAWAIIAN WATERSHEDS: ISLAND OF OAHU,
Hawaii Univ., Honolulu.

For primary bibliographic entry see Field 02E.
For abstract, see .
W69-00709

ANALOG COMPUTER FOR HYDROLOGIC RESEARCH,

Nevada Univ., Reno.
D. F. Schulke, P. A. Domenico, and G. B. Maxey.

Desert Res Inst, Proj Rep 7, Nov 1966. 30 p, 18 fig, 1 tab. OWRR Project B-005-Nev, A-003-Nev.

Descriptors: *Analog models, *Model studies, Synthetic hydrology, *Mathematical studies, *Darcys Law, Fluid flow, *Theoretical analysis, Groundwater, Surface water, Analog computer, Flow.

Identifiers: Hydrologic phenomena, Electrical phenomena, Ohms Law.

When it is possible to find an analogy between one phenomenon and another that is easier to observe, information about the first can be obtained by observing the second. Such an analogy exists between hydrologic phenomena and electrical phenomena. For solution of hydrologic problems two types of analog computers are used: (1) direct or unique analog is used more often for solving ground water problems. It applies the time variant or transient flow of ground water as simulated by the varying flow of current in electricity. This and other hydrologic parameters are simulated by utilization of the analogy between Darcys Law for flow of fluids and Ohm's Law for flow of electricity; (2) general analog is used more often for surface-water problems and differs from the unique analog in that it is a mathematical rather than a physical analog. It consists of an assemblage of computing elements each capable of some mathematical operation. The analogy between indirect analog and physical system is the equation being solved. Examples of both types of analogs are given. Many surface and ground water problems are thus capable of being analyzed which otherwise would not be attempted due to their complexity and the time normally required for their solution.

W69-00739

THE MECHANISM OF DIRECT SURFACE RUNOFF FROM RAINFALL,

Oklahoma State University, Norman, Agr. Eng. Dept.

Charles E. Rice.

July 1968, 9 p. OWRR Project A-006-Okl.

Descriptors: *Overland flow, *Rainfall-runoff relationships, *Mannings equation, *Darcy-Weisbach equation, Uniform flow, Turbulent flow, Laminar flow, Discharge coefficients, Roughness (Hydraulic), Flume.

Identifiers: *Synthetic grass, Effective bottom.

Research methods are used for developing prediction equations and measuring actual water surface profiles for unsteady spatially varied sheet flow over various surfaces. Procedures for routing various rainfall rates through the sheet flow phase into channel flow are presented. Studies on synthetic grass material show that 2 regimes of flow occur, one when flow depth is less than the height of the grass (laminar flow) and the other when flow depth is greater than grass height (turbulent flow). Because the experimental grass occupied a considerable part of flow depth the physical bottom was assumed as not being representative of the effective bottom. For turbulent flow an effective bottom was determined as the intercept of water surface plotted against discharge to the 0.6 power. The Manning coefficient for turbulent flow range increased a little with discharge and its value (average of about 0.032) indicates that synthetic grass has a high retardance to water flow. (Lang-USGS)
W69-00915

VARIABILITY IN RAINFALL PRODUCING RUNOFF FROM A SEMIARID RANGELAND WATERSHED, ALAMOGORDO CREEK, NEW MEXICO,

Southwest Watershed Research Center, Tucson, Arizona.

J. C. Drissel, and H. B. Osborn.
J Hydrol (Amsterdam), Vol 6, pp 194-201, 1968. 8 p, 6 fig, 4 ref.

Descriptors: Variability, *Runoff, *Rainfall disposition, Watersheds (Basins), Hyetographs, Wet seasons, Hypsometric analysis, Convection, Fronts (Atmospheric), Semiarid climates, Orography, Thunderstorms, *Precipitation intensity, Precipitation gages, *Demonstration watersheds, *Rainfall-runoff relationships, Meteorological data.

Identifiers: Alamogordo Creek (New Mexico).

The study was conducted on the 67 square mile Alamogordo Creek watershed in New Mexico. Rain gage density was approximately one gage for every two square miles. Most winter precipitation occurred as low-intensity rain or snow along slow-moving cold fronts. Summer rains yielded 80% of the annual rainfall and were produced generally by short-duration, high-intensity thunderstorms. Mean annual precipitation for the period (1956-1965) was 11.18 inches, with a standard deviation of 4.92 and median of 10.96 inches. All runoff was produced by summer storms (May through October). Mean annual runoff was 0.37 inches (approximately 20 acre-feet per square mile or 1330 acre-feet), which was 3.3% of the mean annual precipitation. Runoff varied more than rainfall. In 1964 total runoff was only 0.03 inches (107 acre-feet) while in 1960, 2.34 inches (8360 acre-feet) were recorded. About 60% of the total runoff from 1956-1965 was produced in 1960. 93% of the total runoff for the 10 year period occurred during June, July and August. (Blecker-Ariz)

W69-01009

HYDROGEOLOGY OF DESERT BASINS,

Desert Research Institute, Reno, Nevada.

George B. Maxey.

Groundwater, Vol 6, No 5, pp 10-22, Sept-Oct 1968.

Descriptors: *Hydrogeology, *Great Basin, *Nevada, Discharge (Water), Base flow, Geologic investigations, Hydrologic aspects, *Hydrologic budget, Water chemistry, Groundwater basins, Reservoirs, Carbonate rocks, Water resources development, Recharge, *Watersheds (Basins), Drainage patterns (Geologic).

Identifiers: Geologic aspects, *Hydrologic systems, *Regional flow systems, Inter-basin flow, Flow systems.

The hydrologic system of the Great Basin in Nevada was utilized in order to describe salient characteristics of arid basins, to describe some methods used to delineate and define hydrologic

systems and to demonstrate the importance of ground water reservoirs. Ground water systems of the Great Basin consisted of (1) local flow systems with small drainage areas, short flow paths, rare interbasin flow, large fluctuation of springs discharge, low water temperature and low concentration of Na, K, Cl and SO sub 4 and (2) regional flow systems with large drainage areas, long flow paths, common interbasin flow, large discharge of springs and higher concentrations of K, Na, Cl and SO sub 4. Hydrologic approaches included hydrologic budget, water potential and water chemistry studies. Integration of hydrologic, geologic and chemical methods allowed approximate portrayal of many systems, both local and regional. (Affleck-Ariz)
W69-01013

SOME REMARKS ON NON-DARCY FLOW,

Negev Institute for Arid Zone Research, Beersheba, Israel.

Richard Kraft, and Daniel Yaakobi.

J of Hydrology (Amsterdam), Vol 4, No 2, pp 171-181, June 1966. 11 p, 6 fig.

Descriptors: *Darcys law, *Hydraulic gradient, Velocity, Permeability, Porosity, *Clays, Discharge measurement, *Theoretical analysis, *Equations, Model studies.

Until recent times, Darcys law was believed to be valid over the complete range of hydraulic gradients. Instead of discharge velocity being directly proportional to the hydraulic gradient, a nonlinear relationship was found in the low hydraulic existence of non-Darcy behavior revealed that its existence is not firmly supported by experiment. The paper discussed critically four non-Darcy experiments and made suggestions on how they might be improved from an experimental and theoretical viewpoint. There was little agreement as to the theoretical explanation for non-Darcy phenomena. A brief theoretical derivation of Darcys law was given. A new system for determining permeability was described. Non-Darcy flow was discussed briefly from a theoretical perspective. From theoretical considerations, it was suggested that when future permeability tests are made they cover a wide range of different porosities and clay types with varying Chapman-Gouy potentials. (Blecker-Ariz)
W69-01027

WATER RESOURCES OF EAST-CENTRAL MISSISSIPPI, CLARKE, JASPER, LAUDERDALE, NEWTON, SCOTT, AND SMITH COUNTIES--A PROGRESS REPORT,

U S Geological Survey Jackson Miss Water Resources Div.

E. H. Boswell.

U S Geol Surv open-file rep, 14 p, Aug 1968. 4 fig, 3 tab.

Descriptors: *Water resources, *Groundwater, *Surface waters, Mississippi, Aquifers, Water quality, Water yield, Streamflow, Low flow, Water storage, Water utilization, Reservoirs.

Identifiers: East Central Mississippi.

Data obtained in an investigation of the water-resources potential for industrial development in east-central Mississippi are summarized. The area is deficient in perennial streamflow, and it is drained by no large streams. The headwater tributaries of the Pascagoula, Pearl, and Tombigbee Rivers drain the northern part; the Chickasawhay, Leaf, and Strong Rivers drain the southern part of the area. Base flows in the larger streams are low but well sustained; the smaller streams are intermittent. Surface-water flow from the area at low flow may be as little as 100 mgd. Surface supplies must be enhanced by surface storage. One large reservoir is under construction and others are planned. Artesian aquifers underlie the area, may yield large quantities of water, and are largely unused. The two most important aquifers are the Lower Wilcox, under the NE 85% of the area, and the Sparta sand,

Field 02—WATER CYCLE

Group 2A—General

under the SW 80%. Groundwater is soft to moderately hard Na-bicarbonate type at shallow depths, and soft, chloride type with higher total solids deeper. Pollution is a problem only in two creeks in Lauderdale and northern Clarke Counties. (Knapp-USGS)
W69-01031

THEORETICAL CONCEPT OF OXYGEN TRANSFER IN GAS BUBBLE AERATION SYSTEM.

Rhode Island Univ, Kingston.
Calvin P. C. Poon.
Water Resour Center, Completion Rep, July 1968.
11 p, 12 ref. OWRR Project A-015-RI.

Descriptors: *Diffusion, *Aeration, Temperature, Pressure, Flow rates, Turbulent flow, Mathematical models, Oxygen requirements, Gasses, Mass transfer, Bubbles.

A mathematical model was developed for diffused aeration relating the oxygen diffusion coefficient to its controlling factors such as temperature, pressure, bubble size, and rate of air flow. By considering the diffused aeration as a 2-step process, namely molecular diffusion and turbulent diffusion, the model was developed using the principle of statistics of molecular motion as well as a hydraulically defined surface renewal rate. The mathematical model should help engineers and operators in aeration practice to understand and to control better the process.
W69-01129

APPLICATION OF ELECTRONIC ANALOG COMPUTER TO SOLUTION OF HYDROLOGIC AND RIVER-BASIN-PLANNING PROBLEMS: UTAH SIMULATION MODEL II,

Utah State Univ, Logan.
J. Paul Riley, Duane G. Dhadwick, and Jay M. Bagley.
Rep REWG 32-1, Water Res Lab, Oct 1966. 129 p, 41 fig, 9 tab, 52 ref, 2 append. OWRR Project B-005-UTAH.

Descriptors: Surface runoff, Groundwater, *Model studies, *Analog computers, Infiltration, Rainfall, Runoff, Snowmelt, Evapotranspiration, Deep percolation, Precipitation (Atmospheric), Temperature, Hydrologic data, Insulation, Water yield, Water yield improvement, *Hydrology, Research and development, *Water resource development, Soil moisture.

As demand on water supplies increase, there is an accompanying increase in the need to assess consequences resulting from changes at specific locations. At Utah State University this problem is being approached by electronic analog simulation of the hydrologic system. Modeling concepts are based upon development of basic relationships which describe the various hydrologic processes. Within a system, these relationships are linked by the continuity-of-mass principle which requires a hydrologic balance at all points. Once established, the model is applied to any particular geographic unit by determining the appropriate constants of the hydrologic equations. The complexity of a hydrologic model depends largely upon the magnitude of time and spatial increments utilized in the model. In this study the mathematical development was based on the concept of relatively small increments of space and large time increments. The model is therefore applicable to in-basin problems involving a time increment of, for example, 1 month. The Circle Valley subbasin of the Sevier River system was simulated to verify the model. Close agreement between computed and observed outflows was achieved on a monthly and total annual basis.
W69-01145

AN EXPERIMENTAL RAINFALL-RUNOFF FACILITY,

Colorado State Univ, Fort Collins.

W. T. Dickinson, M. E. Holland, and G. L. Smith.

Colorado State Univ Hydrol Pap 25, Sept 1967. 81 p, 13 fig, 4 tab, 255 ref. OWRR Project B-005-COLO.

Descriptors: Artificial storms, *Demonstration watersheds, *Model studies, Overland flow, *Small watersheds, Erosion, Water pollution, *Test facilities, Watersheds, Runoff, Rainfall, Models, Research and development, Bibliographies.

Identifiers: *Rainfall-runoff relation, Research facilities, Hydrologic models.

Part I. An experimental facility is described for investigation of rainfall-runoff relationship. The facility is large enough to respond as a prototype watershed, but small enough to permit controlled variation of watershed characteristics and artificial application of a rainfall. Criteria for the facility are related to: (1) control of reasonably uniform rainfall, (2) measurement of variables, with attention to variations in time and space, and (3) variation of watershed parameters. The experimental facility has potential application in studies of rainfall runoff response, erosion, and travel of pollutants on watersheds. Part II. Design and construction of rainfall-runoff experimental facility is described. Three phases are discussed: (1) site selections, (2) selection of basic geometry of facility, and (3) design and construction techniques of site preparation, methods of precipitation and discharge measurement with automatic digital recording of data, soil surface treatment, and proposed precipitation towers. Part III. A review and appraisal of status of mathematical models of hydrologic watershed response is followed by an annotated bibliography of 226 references relating studies of watershed response.
W69-01162

THE EFFECTS OF GEOGRAPHICAL AND CLIMATIC SETTING ON THE ECONOMIC ADVANTAGES OF ALTERNATIVE FLOOD CONTROL MEASURES,

Kentucky Univ Water Resources Inst, Lexington.
Clyde R. Dempsey.
Kentucky Univ Water Resources Inst Res Rep No 10, 166 p, 1968. 26 fig, 45 tab, 32 ref, 5 append. OWRR Project A-001-Ky.

Descriptors: *Flood control, *Climatology, *Watersheds (Basins), Computer programs, Urbanization.

Identifiers: *Pond Creek, Kentucky, Drainage area.

A joint research project was undertaken to evaluate the effects of climatic setting and geographical location on relationships of flood peaks and flow regime in a given watershed. A previously developed Stanford Watershed Model was applied to a drainage area near Louisville, to illustrate the optimum flood control program in a growing urban area in a humid climate. This general study was done to alleviate flood damages through the construction of structural measures for flood control, since the work already done had not fully achieved its intended purpose. In this joint research project, 2 computer programs were developed to facilitate mathematical steps in the design process to be applied to a particular flood plain. The hydrologic input data required for the computer program involves flood peaks and flood hydrographs as functions of tributary or urbanization, channelization, and drainage area. (Llaverias-USGS)
W69-01172

REVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SELECTED WATERSHEDS IN MINNESOTA,

Minn Univ, Anthony Falls Hydraul Lab, Minneapolis.

C. Edward Bowers, and Arthur F. Pabst.
Minn Univ St Anthony Falls Hydraul Lab Proj Rep No 97, 32 p, June 1968. 55 fig, 8 photo, 9 tab, 10 ref, 5 append. OWRR Project A-013-Minn.

Descriptors: *Rainfall-runoff relationships, *Depth-area-duration analysis, *Discharge (Water), Mathematical models, Flood routing, Minnesota.

Available rainfall and runoff data for selected watersheds in Minnesota were analyzed to assist in the evaluation of peak rates of runoff for design purposes; 6 watersheds were selected for study. Rainfall and runoff data were analyzed for 51 flood events in 5 of 6 watersheds. A computer program prepared by the U S Army Corps of Engineers Hydrologic Engineering Center was used to optimize 9 variables associated with the watersheds, develop characteristic unit hydrographs, and evaluate loss rates for the watershed in terms of the mathematical model represented by the optimization program. Data on annual maximum floods as well as maximum summer floods were plotted on log-probability paper and theoretical flood-frequency curves determined by the log-Pearson Type III distribution. Approximately 200 figures relating to the rainfall-runoff data have been included in the appendices. (Knapp-USGS)
W69-01187

2B. Precipitation

AN INVESTIGATION OF SOME PRECIPITATION PATTERNS OF CALIFORNIA AND ADJACENT REGIONS,

California Univ., Los Angeles.

Charles B. Pyke.

Water Res Center Rept, Apr 1966. 111 p, 18 fig, 13 tab, 45 ref, append. OWRR Project A-016-Cal.

Descriptors: *Atmospheric precipitation, *Rainfall, Meteorology, *Investigations, Climatology, Correlation techniques, Seasons, Seasonal Precipitation (Atmospheric), Correlation analysis, California.

A detailed study of geographical and seasonal distribution of precipitation patterns over the far western U S reveals interesting and complicated features and aids in understanding the large-scale synoptic meteorological processes responsible for production of precipitation. Climatic fluctuations and short-term climatic changes taking place in the precipitation patterns over the region are also studied, and an attempt is made to relate changes in precipitation patterns to changes in atmospheric circulation patterns. Monthly totals of precipitation for 57 selected stations within the region of investigation were used as the data for this project; and computations of seasonal totals and averages over 5- to 30-yr periods were made for all of these data. Definite climatic fluctuations of relatively short duration (10-30 yr) are observable from the computations. In addition a slight overall downward trend in the annual total of precipitation, particularly since 1915, is visible in southern California and along the coast of central California.
W69-00736

LA TEMPORADA DE CICLONES DE 1967 Y SU CONTRIBUCION A LA PRECIPITACION ANNUAL EN MEXICO (The Hurricane Season of 1967 and the Contribution to the Annual Rainfall in Mexico),

Mexico, Del Instituto de Geografía UNAM.

O. E. Jauregui.
Ingenieria Hidráulica en Mexico, Vol 22, No 2, pp 169-176, 1968. 8 p, 4 tab, 2 fig, 3 photo, 5 ref. (Transl. from Spanish by Rita Llaverias).

Descriptors: *Cyclones, *Precipitation excess, *Flood damage, *Mexico, Wind velocity, Soil moisture, Hurricanes, Arid lands, Gulf of Mexico. Identifiers: *Cyclone, *Beulah, Satellite.

The contribution of the 1967 tropical cyclone season to the annual precipitation in Mexico is reported. Beulah, with winds reaching 190 km/hr, caused damage in Mexico equal to that done by Betsy in Louisiana (Sept 1965). Damage caused by Beulah from Martinique to the Tamaulipas border was estimated at 1,000 million dollars. Formed in the Lesser Antilles, Beulah first battered Martinique. Entering the Caribbean south of Puerto Rico, it touched the Dominican Republic, passed over Haiti, and skirted Jamaica at which point winds grew in intensity up to 190 km/hr. Then

Snow, Ice, and Frost—Group 2C

cyclone Beulah hit Mexico. Heavy rains accompanying the hurricane caused numerous floods through half of the country. Nonetheless, these torrential rains made 1967 a good year for arid and semi-arid lands in Lower California and around the Lower Bravo River (Rio Grande). Such phenomena transport much humidity and supply the convective processes necessary to convert moisture into rainfall. A table and a map show numerical values for the contribution of precipitation in selected areas. Other tabular data indicate that rain from tropical cyclones contributes from 13 to 41% of total precipitation along the Atlantic Coast and Gulf of Mexico. Biological and socio-economic aspects involved in modifying the weather are also briefly discussed. Photos of the tropical cyclone made from a satellite show size, shape, and location at different times. (Llaverias-USGS)
W69-00942

WATER RESOURCE OBSERVATORY CLIMATOLOGICAL DATA WATER YEAR 1966 AND PRIOR.
Wyoming Univ., Laramie.

Water Resour Res Inst, Water Resour Series 8, Dec 1967. 323 p, 297 tab.

Descriptors: Data processing, *Climatic data, Climatology, Weather data, *Meteorological data.

Data that have been reduced from hygrothermograph charts and nonrecording precipitation gages are presented in tabular form. The mean, maximum, and minimum temperatures are also shown graphically. The data are transferred to punch cards for computation and tabulating by the University of Wyoming's digital computer. The card format and computer program are presented.
W69-00978

RADAR ESTIMATION OF RAINFALL,
New Zealand Meteorological Service, Wellington.
A. P. Ryan.
J Hydrol (New Zealand), Vol 5, No 2, pp 100-110, 1966. 11 p, 3 fig.

Descriptors: *Rainfall, *Radar, *Weather patterns, *Raingages, Measurement, Equations, *Raindrops, Instrumentation, Remote sensing, Calibrations, Meteorology, Wavelengths.
Identifiers: *Reflectivity.

Preliminary results of using radar to estimate rainfall at Ohakea, New Zealand were given. The radar was calibrated and stability was found satisfactory for short and long periods. Eight recording raingauges were set up in an area of 24 square miles. The area was 14 miles from the radar, and a good line-of-sight visibility was present. All three trials were done on occasions of patchy, mainly light rain and individual rain areas were small. Quantitative radar rainfall measurements were feasible with an accuracy at least as good as that of conventional raingauge networks in most areas. Even in the case where the radar estimate is less accurate than that obtained from the existing raingauge network in arid areas, it has an advantage in that it becomes available as the rain falls and includes valuable data on size and movement of rain areas. (Blecker-Ariz)
W69-01029

ON THE COMPARISON OF PRECIPITATION GAUGES,
India Meteorological Office, Poona.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-01030

TIME DISTRIBUTION OF RAINFALL IN HEAVY STORMS,
Illinois State Water Survey, Urbana.
F. A. Huff.
Water Resources Res, Vol 3, No 4, pp 1007-1019, 1967. 13 p, 8 fig, 8 tab, 8 ref.

Descriptors: *Rainfall, *Rainfall disposition, *Storms, Hyetographs, Histograms, Synoptic analysis, Statistical models.
Identifiers: Rainfall time distribution.

Time distribution relations have been developed for heavy storms on areas ranging up to 400 square miles and presented in probability terms to provide quantitative information on interstorm variability and to provide average and extreme relations for various applications of the findings. It was found that the relations could be represented best by relating per cent of storm rainfall to per cent of total storm time and grouping the data according to the quartile in which rainfall was heaviest. The individual effects of mean rainfall, storm duration, and other storm factors were small and erratic in behavior when the foregoing analytical technique was used. Basin area had a small but consistent effect upon the time distribution. The derived relations are applicable to the Midwest and other areas of similar climate and topography. They can be used in conjunction with published information on spatial distributions and other storm parameters to construct storm models for hydrologic applications. (Author)
W69-01045

OPTIMUM DENSITY OF RAINFALL NETWORKS,
Massachusetts Institute of Technology, Cambridge.
Dept of Civil Engineering.
For primary bibliographic entry see Field 07A.
For abstract, see .
W69-01046

PSYCHROMETRIC TABLES FOR WYOMING,
Wyoming Univ., Laramie.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01159

PATTERN OF PRECIPITATION DISPERSION AS AFFECTED BY DIFFERENT VEGETATIVE COVERS IN MAINE,
Maine Univ, Sch of Forest Resources, Orono.
Charles E. Schomaker.
Includes papers from Maine Farm Res Quart, Vol 15, No 2, July 1967, and from Forest Sci, Vol 14, No 1, pp 31-38, Mar 1968. Water Resources Res Proj Completion Rep, 18 p, July 1968. 7 fig, 2 tab, 17 ref. OWRR Project A-005-ME.

Descriptors: *Interception, *Water loss, *Birch trees, *Coniferous trees, Maine, Stemflow, Snow, Rain, Solar radiation.
Identifiers: *Precipitation dispersion.

The interception of precipitation by conifer and hardwood stands was measured and compared. The conifer stand has a basal area of 140 sq ft per acre and a crown coverage of 75-80%. The overstory trees are 88% spruce with an average diameter of 9 in. The remaining 12% of the overstory is white pine with diameters of 16 in. or more. The hardwood stand is 68% white birch, 22% red maple, and some beech and hemlock. Diameters average 5-6 in. Basal area is 100 sq ft per acre, and crown coverage is 80-85%. Precipitation was 35.65 in. from 79 storms. Snow fell in 21 of the storms. The spruce intercepted 35.5% and the birch, 17.9%, and in both stands, winter interception was higher. The birch intercepted about the same percentage in winter and summer, but the spruce intercepted significantly more in winter. Precipitation and interception data are tabulated. (Knapp-USGS)
W69-01173

2C. Snow, Ice, AND Frost

ATMOSPHERIC PROCESSES INVOLVED IN PRECIPITATION,
Alaska Univ., College.
Takeshi Ohtake.

Inst of Water Resour Rept 1968. 14 p, 16 fig, 3 tab, 8 ref. OWRR Project A-001-Alas.

Descriptors: *Ice, *Water vapor, Ice-water interfaces, *Fog, *Alaska, Cryology, Crystal growth, Air pollution, Air temperature, Moisture uptake, Atmospheric physics, Precipitation (Atmospheric), Drops (Fluid), Arctic.
Identifiers: Ice fog, Ice crystals.

This study began in the fall of 1964 in the Fairbanks area of Alaska. It involves an inquiry into sources and role of water vapor in ice fog, investigation of the relative concentrations of ice-fog particles, ice nuclei and condensation nuclei, and examination of the characteristics of nuclei and crystals by electron microscopy. With the electron microscope it was found that most nuclei of ice crystals which developed from sublimation of water vapor were located at the center of the ice crystals. In contrast, ice-fog particles result from freezing of super-cooled water droplets which form by condensation of water vapor from man-made sources of air pollution such as exhaust gases, open water surfaces on cooling pond, etc. The nuclei in these particles are not located in the center. Dense ice fog covering small areas originated from open water where the condensation nuclei concentration was much lower than in the downtown area, while thin but widespread ice fog was observed in the downtown area and along the highway. Dense ice fog was associated with large sources of moisture regardless of whether or not nuclei were abundant. The role of ice-forming nuclei and a preliminary consideration of synoptic conditions which cause ice fog is also discussed.
W69-00712

PREDICTION OF BEGINNING AND DURATION OF ICE COVER,
Colorado State Univ., Fort Collins.
John C. Ward.
Sanit Eng Pap No 2, Sept 1966. 34 p, 6 fig, 7 tab, 14 ref. OWRR Project A-003-Colo.

Descriptors: Surface waters, Temperature, *Oxygen demand, Thermal pollution, Sanitary engineering, Navigation, Fish, Water cooling, *Ice.
Identifiers: *Ice cover, Stream reaeration.

Ice cover is related to the capacity of streams to assimilate wastes because it cuts off air contact, and winter conditions may, in certain circumstances, produce greater oxygen deficits than summer conditions, in spite of the slower rates of deoxygenation and the higher oxygen saturation values of cold waters. The annual variation of stream water temperature can be well represented by a sine curve for most streams. However, streams in cold regions may be frozen over for as much as six months per year. In order to represent the annual variation of stream water temperature for these streams, a modification of the sine curve is necessary. The validity of the modified curve for streams that are frozen over for a portion of a year is indicated in that the duration and beginning date of ice cover is reasonably well predicted, and the stream water temperatures for the rest of the year are also predicted with a fair amount of accuracy. The effects of thermal pollution on the sine curve are reviewed, and the possible effect on ice cover is indicated. The possible application of the sine curve to lakes and reservoirs is illustrated. (Author)
W69-00715

WATER TEMPERATURES IN A SHALLOW LAKE DURING ICE FORMATION, GROWTH, AND DECAY,
U. S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire.
Michael A. Bilelo.
Water Resources Res, Vol 4, No 4, pp 749-760, Aug 1968. 20 p, 13 fig, 21 ref.

Descriptors: *Iced lakes, *Ice, *Ice-water interfaces, *Water temperatures, Limnology, Melting, Thawing, Melt water, Michigan, Heat budget.

Field 02—WATER CYCLE

Group 2C—Snow, Ice, and Frost

Identifiers: Seneca Lake, Ice formation, Shallow lake, Iceathaw periods, Ice decay.

Water temperature variations were measured continually and automatically recorded at Seneca Lake, near Houghton, Michigan, during conditions of ice formation, growth, and decay. A minimum of 0.2 deg C was recorded from just below the surface to the bottom of the lake before complete freeze-over occurred. The water temperature near the bottom of the lake increased from 0.3 to 3.0 deg C. A quantitative analysis of this heat gain attempts to show that most of the heat resulted from energy stored during the summer in the underlying soils. During the April ice-thaw period, the temperature throughout the main mass of water decreased substantially. Since the lake until this time was in a state of quasi-stable thermal stratification, it was assumed that this cooling resulted from the mixing of meltwater flowing into the lake from the surrounding snow. The sudden decrease in water temperatures coinciding with above-freezing air temperatures may be due to these physical processes: (1) near-freezing water released at the underside of the ice sheet as the ice melts; (2) ponding of melt water on the surface of the lake; (3) gravity flow of snow melt water (less than 4 deg C) from around the lake. (Llaverias-USGS)
W69-00930

WATER COOLING AND ICE THICKENING ON DINGMAN CREEK, NEAR LONDON, ONTARIO,
Alberta Univ, Edmonton, Canada.
Edward S. Spence.
Ontario Geogr, No 2, pp 49-66, 1968. 3 fig, 2 tab, 14 ref.

Descriptors: *Freezing, *Streams, *Water temperature, Correlation analysis, Air temperature, Humidity, Solar radiation, Streamflow, Wind velocity, Regression analysis.
Identifiers: Ontario.

The freezing processes of 2 small streams, near London, Ontario were studied by collecting a complete hourly record of air temperature and relative humidity from Nov 11, 1966 to Feb 28, 1967 partial records of sunshine and wind, daily water temperature data from 12 thermocouples at 1 ft intervals in a pond on one of the creeks, and daily water temperature taken in a turbulent stretch of the stream. Ice thicknesses were measured and daily mean ice thickness was calculated. Multiple correlation and regression techniques were used to relate water temperature, the dependent variable, to air temperature, humidity, sunshine, wind, and discharge. Ice thickness growth may be related to the variables by 2 equations with predictive potential, but data must be collected for several more seasons before they can be accurately evaluated. (Knapp-USGS)
W69-01167

2D. Evaporation and Transpiration

WATER LEVEL FLUCTUATION IN EVAPOTRANSPIROMETERS,
U. S. Geological Survey, Phoenix, Arizona, Water Resources Division.
T. E. A. Van Hyckama.
Water Resources Res, Vol 4, No 4, pp 761-768, Aug 1968. 5 fig, 24 ref.

Descriptors: *Water level fluctuations, *Evapotranspiration, *Instrumentation, Water balance, Arizona, Water levels, Groundwater, Soil moisture.
Identifiers: *Evapotranspirometer tanks, *Salt-cedar.

To measure the water use by saltcedar, and to compare the quantities measured with those computed by various empirical and physical methods based on meteorological phenomena, 11 plastic-lined

evapotranspirometer tanks were constructed near Buckeye, Arizona. Artificially maintained groundwater levels show distinct diurnal fluctuations in these instruments. On bare tanks or on vegetated tanks that are not transpiring, this fluctuation is highly correlated with diurnal and semidiurnal atmospheric fluctuations. Possible reasons for such response are discussed: (1) There might be air bubbles in the saturated zone; (2) It might be caused by the flexible plastic lining of the tank. Barometric efficiency is about 40%. On vegetated tanks that are transpiring, the water level and barometric curves are out of phase, but if the water levels are corrected for atmospheric pressure fluctuations, a curve appears that represents the hourly rate of water use. The graphs presented show how diurnal atmospheric pressure effects can be masked and yet can have influenced the water level in transpiration wells. The results may be important in the interpretation of transpiration well data. (Llaverias-USGS)
W69-00924

ESTIMATING EVAPOTRANSPIRATION IN A HUMID REGION,

Board of Agriculture, Helsinki, Finland, and Soil and Water Conservation Res Div, Agricultural Research Service.

Seppo E. Mustonen, and J. L. McGuinness.
U S Dep of Agr Tech Bull No 1389, 123 p, July 1968. 42 fig, 22 tab, 57 ref.

Descriptors: *Cover crops, *Evapotranspiration, *Humid areas, *Statistical models, *Watersheds (Basins), Lysimeters, Soil moisture, Water balance, Precipitation (Atmospheric), Solar radiation.

Identifiers: *Potential evapotranspiration, Scale weight lysimeter readings, Water budget.

An investigation was made of the problem of estimating evapotranspiration in a typical humid region with an abundant and evenly distributed monthly precipitation. Evapotranspiration models were derived from data obtained through large weighing lysimeters for which moisture storage change data were available. The models were then applied on natural watersheds to check the appropriateness of the models and to derive coefficients for use in watershed studies. Evapotranspiration data obtained this way was related to climate and water availability by the use of statistical models derived by multiple regression. The influence of evapotranspiration of different plant covers on watersheds was studied. Climatic variables used in computing daily lake evaporation were mean daily air temperature, mean daily dew point temperature, daily windspeed, and daily solar radiation. Scale weight readings from the lysimeter were correlated with neutron scattering and gypsum block measurements outside the lysimeter to obtain yearround estimates of daily soil moisture. Lysimeter evapotranspiration data obtained from these formulas were somewhat higher than those obtained from natural watersheds. (Llaverias-USGS)
W69-00939

PILOT EVAPOTRANSPIRATION STUDY: LYSIMETER DESIGN,

Hawaii Univ., Manoa.
Paul C. Ekern.
Tech Rep 13, Water Resour Res Center, Aug 1968. 26 p, 8 fig, 53 ref. OWRR Project A-010-Hi.

Descriptors: *Lysimeters, Equipment, Evaporation, *Evapotranspiration, Hydrologic cycle, Micrometeorology, Winds, *Fine-textured soils, *Soil water, Moisture availability, Soil temperature, *Consumptive use, Water requirements, Pressure measuring instruments, Tensiometers, *Sugarcane.

Based on field experience with hydraulic lysimeter for the evapotranspiration of pineapple, nylon reinforced butyl rubber bolsters formed hydraulic load cells to support 3 by 3 by 1.52-m-deep filled lysimeter for sugarcane. Stability was achieved by placing

several of the bolsters at right angles to the others. Polyester resin, fiber glass reinforced tanks have paper honeycomb strengthened bottoms. Large tensiometers of Povic membrane were used to remove percolate to simulate field capacity of 0.1 bar in the low humic latosol. The open end manometers used for measurement of pressures in the cells must be protected from wind and temperature fluctuations.
W69-00981

DIFFUSION THROUGH MULTIPERFORATE SEPTA,

Richard Lee.

Water Resour Inst Rep, Conn A-002, June 1966. 4 p. OWRR Project A-007-Conn.

Descriptors: *Transpiration, *Stomata, Diffusion, Plants, *Leaves, *Plant physiology, Respiration, Biological membranes, Evapotranspiration.

Theories were tested on the dependence of membrane diffusion rates on pure size and number over the range of variables characteristic of leaf epidermis. Plant canopies are not passive evaporating surfaces. The regulation of water loss from plants is an important function of leaf stomata, and significant stomatal regulation occurs throughout the range of leaf pore diameters. Leaf pores do not significantly interfere with one another in conducting water vapor or other gases. The diffusive conductance of small pores is more sensitive to diameter changes at larger apertures, permitting carbon dioxide exchange for photosynthesis without dehydration of the leaf mesophyll. In still air the external resistance over broad leaves limits control by stomata, but light drafts minimize this effect in field situations. Characteristic diffusion coefficients for leaf types, based on a careful study of leaf microstructure, physiology, and seasonal variation, is a rational basis for cover-type conversions or biochemical controls to reduce water loss.
W69-00988

THE AVAILABILITY OF SUB-SURFACE WATER IN MISSOURI FOR CONSUMPTIVE USE BY PLANTS,

Missouri Univ., Columbia, Soils Dept.
C. L. Scrivner, and Wayne L. Decker.

See also, Decker, Wayne L., 'Potential Evapotranspiration in Humid and Arid Climates,' reprinted from Conf Proc, Evapotranspiration and its Role in Water Resources Management, Dec 5-6, 1966. pp 23-26. Termination Rep, Nov 22, 1967. OWRR Project B-005-Mo.

Descriptors: Alluvium, Soil types, Water storage, *Evapotranspiration, Irrigation requirement, Irrigation effects, *Soil surveys, Climatology, Water requirements, Laboratory tests, Moisture uptake, Moisture content.
Identifiers: Soil maps, Missouri River Basin.

Using a reconnaissance technique which was developed for rapid and preliminary soil survey work, soil types from over 400,000 acres of land in the alluvium along the Missouri river were identified. Boundaries for each soil type are shown on maps in the appendix of this report and acreages associated with each soil type are also listed in the appendix. Concurrent laboratory examinations provided estimates of the water-holding capacities for each of the soil types. Less than 5% of the area had low storage capacities; while 60% of the area had storage capacities in excess of 6 in. of available water in the top 4 ft of soil. The requirement for irrigation of each soil was estimated. Using data from weather stations of the area, the requirement was obtained by simulating the daily water balance of each soil from measurements of rainfall and estimates of evapotranspiration. Soils with low storage capacities need more irrigation than those with high capacities. An attached reprint shows more than 10 in. of supplemental water required for 4 yr out of 10 for the former soil and less than 2 yr out of 10 for the latter soil types.
W69-00999

Evaporation and Transpiration—Group 2D

THE MECHANICS OF FLUID TRANSPORT IN VEGETATION,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 021.
For abstract, see .
W69-01002

AN APPRAISAL OF ADVECTION CONTRIBUTIONS TO OBSERVED EVAPORATION IN AUSTRALIA USING AN EMPIRICAL APPROXIMATION OF PENMAN'S POTENTIAL EVAPORATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia), Div of Land Research.

Eugene A. Fitzpatrick.
J Hydrol (Amsterdam), Vol 6, No 1, pp 69-94,
January 1968. 26 p, 10 fig, 5 tab, 33 ref.

Descriptors: *Evaporation, *Vapor pressure, *Temperature, *Climatic data, Diurnal, Advection, Humidity, Arid lands, Correlation analysis, Radiation, Regression analysis, Energy, Evapotranspiration, *Approximation method, Regional analysis.

Identifiers: Western Australia, Tank evaporation, Energy balance, *Penman's potential evaporation.

A method was developed for obtaining an approximation of Penman's potential evaporation using data obtained in field studies of growth and water-use characteristics of cotton at Kununurra, Western Australia. Using daily data, a distinctive linear relationship between the weighted vapor pressure deficit and Penman evaporation was identified for periods with low advection. Reasonable close approximations of Penman's potential evaporation over periods of 10 days or longer could be made solely from temperature and vapor pressure data over a wide range of climatic environments in Australia. A regional appraisal of advective contributions to the observed or estimated rates of tank evaporation using energy balance considerations was difficult in Australia because of the paucity of radiation (or sunshine) and evaporation measurements over large parts of the continent. (Blecker-Ariz)
W69-01011

WATER CONSUMPTION BY PHREATOPHYTES,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 03B.
For abstract, see .
W69-01012

ATTRACTION OF ATMOSPHERIC MOISTURE BY WOODY XEROPHYTE IN ARID CLIMATES,
Volcani Institute of Agricultural Research, Rehovot, Israel.
For primary bibliographic entry see Field 03B.
For abstract, see .
W69-01014

ROLE OF ANTITRANSPIRANTS WITH SPECIAL REFERENCE TO WATER TURN-OVER IN ARID PLANTS,
Central Arid Zone Research Institute, Jodhpur, India.
A. N. Lahiri.
Annals of Arid Zone, Vol 5, No 1, pp 97-104,
March 1966. 8 p, 1 tab.

Descriptors: *Water loss, Arid lands, *Desert plants, *Transpiration control, Photosynthesis, Soil-water-plant relationships, soil moisture, *Retardants, Monomolecular films, Evaporation control.
Identifiers: *Antitranspirants.

Water loss by transpiration under desertic conditions is a serious problem because of the great bulk that is lost to the atmosphere. A review of various antitranspirants with particular reference to water

turn-over in arid plants is given. The requirements for a successful antitranspirant are listed. The effect of antitranspirants on photosynthesis were discussed. It was suggested that plant antitranspirants have a great possibility for moisture conservation in arid and semi-arid areas where native plants commonly transpire at a very fast rate until low soil moisture reduces the rate of transpiration. (Affleck-Ariz)
W69-01020

A TECHNIQUE TO DETERMINE EVAPORATION FROM DRY STREAM BEDS,
Ariz. Univ., Tucson. Institute of Atmospheric Physics.

Michael J. Fox.
J of Applied Meteorology, Vol 7, No 4, pp 697-701, Aug 1968. 4 p, 5 fig.

Descriptors: *Evaporation, Dry seasons, *Streambeds, Thermometers, Temperature, Winds, *Hydrologic budget, Anemometers, Energy budget, *Equations, Meteorological data, *Statistical methods, Soil moisture, Water balance, Lysimeters.

Identifiers: Hydrologic balance.

In the desert southwest washes or dry stream beds are numerous. For one or two days after thunderstorm flooding, up to 7 mm. of water evaporates each day. While insignificant in a limited area and time, this evaporation, when totaled over a large area and long period, may be important in the hydrological balance of arid regions. A technique is described to determine 24 hr. stream-bed evaporation subject to the constraints that it be inexpensive, uncomplicated, and accurate to within plus or minus 20%. The result of statistical evaluation of the prediction equation on the experimental data gave an average percentage error of 13% and a standard error of 0.88 mm. (Affleck-Ariz)
W69-01026

LYSIMETER AND WATERSHED EVAPOTRANSPIRATION,
Board of Agriculture, Helsinki, Finland, and Agricultural Research Service, Coshocton, Ohio.
Seppo E. Mustonen, and J. L. McGuinness.
Water Resources Res, Vol 3, No 4, pp 989-996, 1967. 8 p, 2 fig, 3 tab, 12 ref.

Descriptors: *Evapotranspiration, *Lysimeters, *Statistical models, Regression analysis, Hydrologic budget, Small watersheds.

A statistical model was derived by regression analysis for permanent grass lysimeter evapotranspiration, using lake evaporation, soil moisture, and precipitation as independent variables. Measured evapotranspiration was greater than values estimated from water budgets on small watersheds. Differences for permanent grass and grain crops were greatest at planting time when the ground was bare. Evapotranspiration was about 1/2 of normal when hay was cut; it returned to normal in about a month. Reforestation increased evapotranspiration about 35% on a reforested study plot. (Knapp-USGS)
W69-01054

GENERALIZED ESTIMATES OF FREE-WATER EVAPORATION,

Weather Bureau, Washington, D. C. and Agricultural Research Service, University Park, Pa.
M. A. Kohler, and L. H. Parmelee.
Water Resources Res, Vol 3, No 4, pp 997-1005, 1967. 9 p, 7 fig, 1 tab, 27 ref.

Descriptors: *Evaporation, *Reservoir evaporation, *Lakes, Mass transfer, Energy budget, Environmental effects, Solar Radiation, Temperature.

A modified method for deriving free-water evaporation estimates from network observations of air temperature, dew point, wind movement, and incoming minus reflected radiation is presented.

Taking into account the difference between air and water temperature in computing emitted radiation from the water surface, the expression is an improvement over the original Penman type equation where observation of net radiation over the actual water surface is lacking. The accuracy of the method depends on the applicable mass transfer wind function. Techniques are derived to adjust for the effects of advected energy and heat storage when applying the free-water evaporation estimate to actual water bodies. Computations of lake evaporation made with the modified method for a number of locations where verification data are available indicate that the relation provides a suitable basis for estimating actual evaporation without the expense of continuous over-water observations. (Author)
W69-01055

THE HYDRODYNAMIC AND ENERGY BUDGET ASPECTS OF PAN EVAPORATION.

Cornell Univ., Ithaca, N.Y.
Wilfried Brutsaert.
Tech Rep 7, Water Resour Center, Aug 1967. 38 p, 1 fig, 13 tab, 23 ref. OWRR Project A-004-NY.

Descriptors: *Evaporation, Evapotranspiration, *Evaporation pans, Transpiration, Mass transfer, Solar radiation, Wind velocity, Winds, Shear stress, *Energy budget, Diffusion, *Hydrodynamics.

An analysis is presented of experimental evaporation data which were obtained with shallow, square pans of different sizes and colors. The results are given of the computations of regression analysis relating evaporation with the difference between the water vapor pressure at the water surface and in the air, pan size, wind speed at various elevations and shear stress. These relationships are expressed by different equations for mass transfer whose functional form is widely accepted in the literature or derivable by means of theoretical diffusion models. The shear stress—or the friction velocity—was calculated in 4 different ways, namely by solving the following wind speed profile laws with wind speed data at different elevations; the logarithmic, the log-linear, the log-square root and the log-exponential law. A comparison is presented of the correctness of fit obtained with the different models.
W69-01136

ESTIMATING INCIDENT TERRESTRIAL RADIATION UNDER ALL ATMOSPHERIC CONDITIONS,

Environmental Science Services Administration, Washington, D.C., Office of Hydrology.
E. A. Anderson, and D. R. Baker.
Water Resources Res, Vol 3, No 4, pp 975-988, 1967. 14 p, 13 fig, 3 tab, 20 ref.

Descriptors: *Atmospheric physics, *Radiation, *Evapotranspiration, Energy transfer, Meteorology, Hydrology, Data collections, Humidity, Snowmelt, Instrumentation.

Identifiers: *Atmospheric radiation, Energy balance, Data network.

The application of a complete energy balance to computations of evaporation or snowmelt requires radiation data, of which there is presently reasonable coverage from a network of incident solar radiation stations. A network of all-wave radiometers does not exist. Therefore, to apply the energy budget technique to hydrological problems, incident long-wave radiation must be estimated. An empirical equation is developed by which incident long-wave radiation can be computed from observations of surface air temperature, vapor pressure, and incident solar radiation. Comparisons of estimated and observed incident long-wave radiation at 6 sites lead to the following conclusions: (1) The equation should give results comparable within a few percent on a 6-months basis or longer; (2) For any specific atmospheric condition, there seems to be no tendency for the equation to over or under compute or give increased scatter; (3) When data

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for 6 months or more are analyzed, correlation coefficients of about 0.90 were obtained between computed and observed daily radiation values. (Lang-USGS) W69-01193

2E. Streamflow and Runoff

HYDROLOGICAL DATA AND PEAK DISCHARGE DETERMINATION OF SMALL HAWAIIAN WATERSHEDS: ISLAND OF OAHU, Hawaii Univ., Honolulu.

Wu I-Pai.

Water Resour Res Center Tech Rep 15, Dec 1967. 97 p, 26 fig, 13 tab, 46 chart, 43 ref, append. OWRR Project B-003-Hi.

Descriptors: *Watersheds, Overland flow, Rational formula, Surface runoff, *Rainfall, Streamflow, Design criteria, *Hydrology, Flood forecasting, Geomorphology, Soil structure, Land utilization, Rain gages, Runoff forecasting, Stream gages.

Identifiers: *Flood hydrology, Flood frequency, Multiple regression, Flow estimate, Hawaii, Oahu.

Basic hydrological data including rainfall, runoff, historical flood, watershed characteristics, soil type, and land use of Hawaiian small watersheds on Oahu have been compiled and analyzed. Frequency analysis for annual peak discharge was made for 23 small watersheds on Oahu by using Gumbel's extreme value theory. A regional flood formula has been derived for Honolulu and between mountain ranges of the island of Oahu through the use of multiple regression. The regional flood formula expressing peak discharge as a function of watershed area, length and height and a precipitation index defined as 100-yr, 24-hr rainfall in in. can be used to estimate peak discharges for ungaged areas. The rational formula which is currently used for drainage areas less than 100 acres has been evaluated through the study of overland flow.

W69-00709

RECESSION CHARACTERISTICS OF IOWA STREAMS: PART I - TEMPORAL AND AREAL DISTRIBUTION OF RECESSION CONSTANTS, Iowa State Univ., Ames.

J. W. Howe.

Water Resour Res Inst Rept, June 1966. 150 p, 144 fig, 1 tab. OWRR Project A-004-1a.

Descriptors: *Streams, *Streamflow, Forecasting, Irrigation, Water users, *Streamflow forecasting, Hydrometeorological station, *Iowa, *Low flow, *Recession curves, Summer, Withdrawal.

This report covers behavior of Iowa in low-water periods during the crop-growing season, May to Sept inclusive. All such periods of 10 days or more in length were analyzed to determine the recession constants. Results are shown on a map of the State and indicate a considerable uniformity of behavior during each of the summer months. Data contained in this report should enable prediction of ground-water streamflow with reasonable accuracy for a period of 1 to 2 weeks in advance if no rain falls, and thus make it possible to give an irrigator several days to a week's notice of the time when the withdrawal from a stream must be terminated. This phase of the project discovers a consistency of recession coefficients at existing stream gaging stations in the summer months which should be useful in predicting the time of occurrence of particular low-water flows. The second phase of investigation will deal with the relation of magnitude of low-water flow at the beginning of a period of recession to associated parameters such as basin area, antecedent rainfall, and soil types.

W69-00718

THE MECHANISM OF DIRECT SURFACE RUNOFF FROM RAINFALL, Oklahoma State University, Norman, Agr. Eng. Dept.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-00915

PLANFORM ANALYSIS OF MEANDERING RIVERS,

Purdue University, Lafayette, Indiana.
G. H. Toebes, and T. P. Chang.
Purdue Univ Eng Reprints CE 242, pp 362-369, Feb 1968. 8 p, 5 fig. OWRR Project A-003-Ind.

Descriptors: *Meanders, *Time series analysis, Frequency analysis, Discharge (Water), Width, Streamflow, Hydraulic similitude, Hydraulic properties.

Identifiers: Ergodic properties.

The planform of meandering rivers is analyzed statistically to improve the analyses made by deterministic approaches and to gain an idea of the relative significance of deterministic and random planform components. The White River Valley in Indiana was selected for a field study and time-series analysis. The data appeared to be non-stationary and spectral characterization of meander planform is likely to require trend removal. A substantial random component is present and the relation between hydrology and meander shape is equally random. Cross-correlation of local planform with local width, depth, slope, and other local factors appears necessary, but these dimensions are difficult to measure reliably. Time trends in river hydraulic behavior are also unpredictable but necessary to define. So far, results show that the search for deterministic equations may be futile. (Knapp-USGS)

W69-00917

SOME RECENT STUDIES ON NUMERICAL FLOOD ROUTING.

North Carolina State University, Raleigh.

Michael Amein.

3rd Annual Amer Water Resources Conf Proc, pp 273-284, Nov 8-10, 1967. 6 fig, 11 ref.

Descriptors: *Flood routing, *Flood forecasting, *Mathematical studies, *Digital computers, Hydrographs, Unsteady flow.

Identifiers: Numerical flood routing.

The results of an investigation of fundamental aspects of numerical flood routing based on the solution of the equations of unsteady flow are presented. Brief reviews of the approximate methods and their solutions, and discussions of the explicit method, the characteristic method, and the implicit method, including factors affecting the stability and accuracy of the solutions, are given. An example of a flood flow problem is solved using the IBM 360 computer. The times of arrival and the depth values of flood peaks calculated by the various methods are essentially the same. The explicit method is the least efficient in computer time, but the simplest to use. (Knapp-USGS)

W69-00922

STREAM TEMPERATURE STUDY, NORTH FORK SNOQUALMIE RIVER, WASHINGTON, Washington Univ., Seattle, Civil Eng. Dept.

Ronald E. Nece.

Tech Rep 23, Dep Civ Eng, 1967. 49 p, 9 fig, 3 tab, 11 ref. OWRR Project A-012-Wash.

Descriptors: Heat budget, Solar radiation, Air temperature, *Water temperature, Hydrology, *Rivers, Running waters, Hydrologic data, Hydrometeorological station, Stream flow records, Streams, Temperature.

Identifiers: *Micrometeorology, Snoqualmie River, Wash.

The upper basin of the North Fork of the Snoqualmie River was used for a study of stream temperatures in the headwater regions of a typical Pacific Northwest mountain river. Water temperature, stream flow, and climatological data are given for the heating season of calendar year 1967. A simplified procedure is suggested for predicting water temperatures at a given station on such a stream. The suggested procedure uses a typical heat energy-budget approach; a number of terms usually considered in heat budget calculations are omitted, while provision is made for consideration of remains to be verified because stream travel times required in the calculations have yet to be obtained on the study river. Measurements of air temperatures and of solar radiation in the test basin indicate that these variables may indeed be satisfactorily predicted on the basis of conventional data obtained at the federal weather station in the same general region. W69-00977

SEQUENTIAL STUDY OF DESERT FLOODING IN THE WHITE MOUNTAINS OF CALIFORNIA AND NEVADA,

Montana Univ., Missoula, Dept. of Geography.

Chester B. Beaty.

U. S. Army NATICK Laboratories, Natick, Mass., Tech Rept ES-37, January 1968. 98 p, 55 fig, 1 map, 11 tab, 21 ref, 1 append.

Descriptors: Canyons, Deserts, *Cloudburst, California, Channel morphology, Alluvial channels, *Debris avalanches, Flood forecasting, *Flash floods, Nevada, Snowmelt, Flood plains, Rainfall-runoff relationships, Wet seasons, *Intermittent streams, *Geomorphology, Storm runoff, Streams. Identifiers: White Mountains, California and Nevada, Alluvial fans, Trunk canyons.

Study of desert flooding and circumstances under which it is likely to be a hazard to activities in and near desert mountains was undertaken in 1956-57 in the White Mountains of California and Nevada. Ten years later the area was restudied to determine extent and nature of land form changes that had occurred during the intervening decade. Three physiographic characteristics influence flooding behavior in a desert stream system. They are: trunk canyon profile, amount of debris on the floor of the trunk canyon and the width of the lower canyon and canyon mouth. The area of greatest flooding danger on a desert alluvial fan is a radial zone extending from the apex toward the margin, flanking and including the active channel. (Blecker-Ariz) W69-01006

INFLUENCE OF SOME PARAMETERS OF A PRISMATIC FLOOD-PLAIN CHANNEL ON THE RATE OF PROPAGATION OF THE CREST OF RELEASE WAVES (NUMERICAL EXPERIMENTS),

M. I. Rusinov.

Soviet Hydrol: Selec Pap, No 2, pp 135-149, 1967. 15 p, 6 fig, 1 tab, 19 ref. Translated from Trudy GGI, No 140, pp 64-82, 1967.

Descriptors: *Unsteady flow, *Open channel flow, *Floods, *Computer models, Digital computers, Hydrographs, Analytical techniques, Synthetic hydrology, Flood plains, Roughness (Hydraulic), Slopes.

Identifiers: USSR, Flood wave propagation, Flood crests.

Flood wave propagation was studied with an algorithmic digital computer model of hypothetical prismatic channels and flood plains. The influences of the width of the flood plain, depth of flooding, and roughness on flood wave crest velocity were analyzed, and were constructed to represent the results. The influence of each variable is discussed in detail. (Knapp-USGS) W69-01038

Streamflow and Runoff—Group 2E

INFLUENCE OF UNSTEADY FLOW ON THE VERTICAL DISTRIBUTION OF AVERAGED VELOCITIES (ACCORDING TO FIELD OBSERVATIONS BY THE STATE HYDROLOGIC INSTITUTE ON THE SVIR RIVER),

N. N. Fedorov.

Soviet Hydrol: Selec Pap, No 2, pp 149-152, 1967. 4 p, 1 fig, 4 ref. Translation from Trudy GGI, No 140, pp 136-139, 1967.

Descriptors: *Unsteady flow, *Open channel flow, *Turbulent flow, *Reservoir operation, Velocity, Distribution patterns.

Identifiers: USSR, Velocity-depth distribution.

The influence of unsteady flow on the vertical velocity-distribution was analyzed in the lower pool of the Nizhne-Svir Hydroelectric Power Plant in winter, 1961. It was found that the average velocity-depth distribution curve does not change significantly upon passage of a release wave but when a new steady state regime is established, a new velocity-depth curve is also established. (Knapp-USGS)
W69-01039

ANALYSIS OF RELATIONSHIPS BETWEEN WATER DISCHARGES AND LEVELS DURING THE PROPAGATION OF RELEASE WAVES IN A PRISMATIC CHANNEL (NUMERIC EXPERIMENTS),

A. A. Ivanova.

Soviet Hydrol: Selec Pap, No 2, pp 121-135, 1967. 15 p, 7 fig, 3 tab, 16 ref. Translation from Trudy GGI, No 140, pp 44-63, 1967.

Descriptors: *Unsteady flow, *Channel flow, *Waves (Water), *Equations, Flow profiles, Model studies, Hydraulic properties, Hydrographs.

Identifiers: Saint Venant equations.

Flow in trapezoidal and rectangular section channels was studied to evaluate various approximate solutions of the Saint Venant unsteady flow equations and to determine the influence of channel storage, channel sectional shape, roughness coefficient, slope, and time profile of the flow release. Since the system of Saint Venant equations, which describes the process of unsteady flow, is nonlinear and cannot be solved analytically in the general form, it is impossible to determine analytically the influence of each of the factors in this complex multiple-factor process. This can be done only on the basis of various assumptions, giving an approximate picture of the influence of these factors. Waves progressing downstream after an abrupt release are represented by loops in the hydrograph of the flow. As a wave diminishes downstream, the hydrograph loop lengthens and thins, until at a sufficient distance from the release point, the wave disappears and the hydrograph curve becomes single valued. Partial data from 200 experimental releases are plotted, and the forms of solutions to unsteady flow equations that may yield waves or hydrograph loops are discussed. (Knapp-USGS)
W69-01040

A THERMODYNAMIC ANALOGY FOR MEANDER SYSTEMS,

U S Geological Survey and Illinois Univ., Urbana. For primary bibliographic entry see Field 02J.

For abstract, see .

W69-01048

SIMPLIFIED VERSUS OPTIMUM UNIT HYDROGRAPHS—ONE COMPARISON,

Georgia Institute of Technology, Atlanta.

Willard M. Snyder.

Water Resources Res, Vol 3, No 4, pp 947-948, 1968. 2 p, 2 tab, 4 ref.

Descriptors: *Unit hydrographs, Hydrograph analysis, Analytical techniques, Mathematical studies, Least squares method.

Identifiers: Iteration methods, Curve fitting.

A unit hydrograph is derived from a record storm previously analyzed for the optimum realizable unit hydrograph. The simplified curve-fitting procedures a more rational appearing unit hydrograph in this case study. The method employs a simple iterative procedure based on calculating corrected values for estimated P sub e from a unit hydrograph, and then constructing a new unit hydrograph using the new value of P sub e. The iteration may be repeated as often as desired for further refinement. (Knapp-USGS)
W69-01052

THE RELATION BETWEEN MAINSTREAM LENGTH AND AREA IN DRAINAGE BASINS,

IBM Watson Research Center, Yorktown Heights, N. Y.

J. S. Smart, and A. J. Surkan.

Water Resources Res, Vol 3, No 4, pp 963-974, 1967. 12 p, 6 fig, 6 tab, 19 ref.

Descriptors: *Watersheds (Basins), *Drainage patterns (Geologic), *Meanders, Geomorphology.

Identifiers: Drainage basin characteristics, River classification, Stream lengths, Stream numbers, Stream sinuosity.

Analyses of small drainage basins show that variations in stream sinuosity can affect the value of the exponent n prime in Hacks length-basin area relationship L prime = C (A to the power n prime). A simple approximate formula relates mainstream length, sinuosity, basin shape, and basin area and shows how the contributions of sinuosity and shape variation may be separated and evaluated. The generally accepted statement that drainage basins are more elongated with larger area needs further investigation. (Knapp-USGS)
W69-01064

MATHEMATICAL ASSESSMENT OF SYNTHETIC HYDROLOGY,

U. S. Geological Survey, Washington, D. C.

For primary bibliographic entry see Field 06A.

For abstract, see .

W69-01056

SYNTHETIC HYDROLOGY BASED ON REGIONAL STATISTICAL PARAMETERS,

U. S. Geological Survey, Washington, D. C.

For primary bibliographic entry see Field 06A.

For abstract, see .

W69-01057

FLOODS FROM SMALL DRAINAGE AREAS IN CALIFORNIA—A COMPILATION OF PEAK DATA, OCTOBER 1958 TO SEPTEMBER 1967.

U S Geological Survey.

Arvi O. Waananen.

U S Geol Surv, Water Resources Div, 143 p, July 1968. 41 fig, 2 tab.

Descriptors: *Data collections, *Floods, *Small watersheds, *California, Discharge measurement, Stream gages, Hydrographs, Precipitation (Atmospheric).

Identifiers: Annual peak stage.

As a part of the cooperative agreement between the California Department of Water Resources and the U S Geological Survey, an investigation of the magnitude and frequency of floods from drainage areas generally of less than 10 sq mi was begun by the USGS in 1958. By the end of 6 years of study, 300 gaging stations were installed, all with crest-stage gages. Annual peakflows, drainage area, elevation of basin, length of basin, slope of basin, vegetal cover, geology of basin, shape of basin, rainfall, and area of lakes and ponds are tabulated. (Knapp-USGS)
W69-01059

AN APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS IN THE STUDY OF WATER YIELD.

Tennessee Univ, Knoxville, Tennessee.

Guillermo Diaz, J. I. Sewell, and C. H. Shelton. Water Resources Research, Vol 4, No 2, pp 299-306, April 1968. 7 tab, 13 ref.

Descriptors: *Water yield, Watersheds, Ohio, Texas, Soil types, Regression analysis.

Identifiers: *Principal component analysis, *Factor analysis, Area, Slope, Cultural practices, Land capability, Varimax rotation.

Principal component and factor analysis were applied to annual precipitation and runoff data of fourteen watersheds from Coshocton, Ohio, and seven watersheds from Riesel, Texas. The objective was to identify the factors affecting the water yield of these watersheds and to determine the relative importance of the identified factors. From the Ohio watersheds, the rotated factor analysis suggested that watersheds area and slope were, in that order, the two most important factors affecting water yield. For the Texas watersheds, three almost equally important watershed factors were identified as the soil type, cultural practices, and land capabilities. A stepwise regression of runoff-precipitation ratios of the Ohio data on area-slope variables substantiated the effects of area and slope on runoff that were determined in the factor analysis. (Seneca-Rutgers)
W69-01064

STEADY AND UNSTEADY EFFECTS ON DISCHARGE IN A RIVER CONNECTING TWO RESERVOIRS.

Cornell Univ, Ithaca, N.Y.

James A. Liggett, and Walter H. Graf.

Tech Rep 5, Water Resour Center, Aug 1967. 10 p, 9 fig, 4 ref. OWRR Project A-009-NY.

Descriptors: Flood routing, Shallow water, Equations, *Unsteady flow, *Steady flow, Roughness coefficient, *Open channel flow, *Streamflow, *Discharge measurement, Lake Huron.

Identifiers: Finite difference method, St Clair River (Michigan).

The effects of the frictional coefficient, lake levels and unsteady flow are considered for a river which joins 2 reservoirs. These effects are studied numerically by using a somewhat idealized model of the St. Clair River, which connects Lake Huron to Lake St. Clair. The analysis shows that each of these factors has a large effect on the flow. An unsteady flow analysis of the river is probably necessary if the lake levels are subject to any major fluctuations. A method is proposed by which the frictional constant can be determined accurately. The adjustment process of the frictional constant can be either internal or external to the machine computation. If the constant is allowed to vary with both depth and distance along the river, quite a number of runs will be necessary to determine it accurately. The present study indicates (but does not prove) that continuous and accurate geometrical data (cross section, slope, etc.) are probably not necessary for such a program.
W69-01137

A LABORATORY INVESTIGATION OF OPEN-CHANNEL DISPERSION PROCESSES FOR DISSOLVED, SUSPENDED, AND FLOATING DISPERSANTS,

U S Geological Survey.

W. W. Sayre, and F. M. Chang.

U S Geol Surv Prof Pap 433-E, pp E1-E71, 1968. 71 p, 60 fig, 11 tab, 51 ref.

Descriptors: *Dispersion, *Open channel flow, *Dissolved solids, *Suspended load, *Floating, Waste disposal, Path of Pollutants.

Identifiers: Open-channel dispersion.

A series of experiments conducted in a rigid-boundary laboratory flume having an artificially

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roughened bed compared longitudinal dispersion of suspended silt-size sediment particles with longitudinal dispersion of a fluorescent dye solution and longitudinal and lateral dispersion of floating polyethylene particles. The longitudinal and lateral dispersion processes for dissolved dispersants and floating particles converged to a Fickian-type diffusion process quite rapidly with increasing dispersion distance. The values of the longitudinal dispersion coefficient for the dye closely correspond to J W Elder's theory. Except in the sediment-dispersion experiments, the dispersion coefficients were approximately proportional to the product of the depth and the shear velocity. The longitudinal dispersion process for suspended silt-size particles resembles the process for the dye, but is modified by the particles settling toward the slower moving flow near the bed and eventually depositing on the bed. The longitudinal distribution of particle deposition can be calculated using T R Camp's theory of the influence of turbulence on sedimentation in settling tanks. The confining effect of the sidewalls on the lateral distribution of dye can be accounted for satisfactorily by the reflection-superposition principle. (Knapp-USGS)

W69-01180

SIMULATION OF OVERLAND FLOW ON SHORT FIELD PLOTS.

U. S. Department of Agriculture, Agricultural Research Service, and Purdue University, Lafayette, Ind.

G. R. Foster, L. F. Huggins, and L. D. Meyer.
Amer Geophys Union, 49th Annual Meeting,
Washington, D. C., Apr 8-11, 1968 (Pap), 10 p,
1968. 5 fig, 1 tab, 4 ref. OWRR Project B-003-IND.

Descriptors: *Overland flow, *Model studies, *Continuity equation, *Uniform flow, *Darcy-Weisbach equation, Fallowing, Roughness coefficient, Roughness (Hydraulic), Rainfall, Discharge (Water), Hydrographs, Slopes.
Identifiers: Kinematic wave theory.

An overland flow model based on the kinematic wave theory was developed to analyze overland flow on short, very rough erosion plots. Simulated rainfall was applied at 2.5 in/hr through nozzles that spray downward as they move across the plot. Plot sizes were 35 ft long and 10 and 12 ft wide; the surface condition was fallow. Field hydrographs were used to estimate retention storage and the Darcy-Weisbach coefficient of friction. The model includes variable point infiltration rate and a variable coefficient of friction, the 'drying up' of the upstream end of the slope during recession, and a variable area infiltration rate that is a function of the water surface area during recession. These were used in the model to simulate hydrographs which were compared with field hydrographs to test the concepts used in the model. The model with a constant Darcy-Weisbach coefficient of friction or Manning's n adequately describes overland flow on short erodible slopes. (Knapp-USGS)

W69-01182

REVIEW AND ANALYSIS OF RAINFALL AND RUNOFF DATA FOR SELECTED WATERSHEDS IN MINNESOTA,

Minn Univ, Anthony Falls Hydraul Lab, Minneapolis.

For primary bibliographic entry see Field 02A.
For abstract, see .

W69-01187

ANALYSIS OF HYDROLOGIC SYSTEMS,

Metcalf and Eddy, Boston, Mass, and Virginia Polytech Inst, Blacksburg.

Tsung Ting Chiang, and J. M. Wiggett.

Virginia Polytech Inst Water Resources Res Center Bull 12, 74 p, May 1968. 36 fig, 49 ref, 1 append. OWRR Project A-013-Va.

Descriptors: *Runoff, *Rainfall-runoff relationships, *Runoff forecasting, *Systems analysis, Simulation analysis, Synthetic hydrology.
Identifiers: Process dynamics, Information theory.

The feasibility of applying systems analysis techniques to hydrology by examining the hydrologic runoff process in terms of fundamental process dynamics is examined. In any system, the output and the input signals may be related by a transfer function, the ratio of the Laplace transform of the output function to the Laplace transform of the input function. If the transfer function of a system is known, the output may be calculated easily from given or assumed input. For simple systems, the transfer function may be derived theoretically by the physical characteristics of the system, but for complex systems, or from a system whose physical relations are not surely known, theoretical formulation becomes impossible, and an experimental approach is called for. The use of analog and digital computers has made possible the application of systems analysis to physical systems that only a few years ago were impossible to analyze. Simplified hydrologic laboratory models were used in developing the mathematical models. Impervious catchments of simple rectangular configuration, sloping 0-8 deg, supplied with uniform rainfall from nozzles, were used and evaporation was neglected. A general transfer function was developed for hydrologic runoff systems. (Knapp-USGS)

W69-01191

2F. Groundwater

WATER WELL YIELDS FROM CRYSTALLINE ROCKS OF NORTHERN NEW JERSEY,

Rutgers Univ., New Brunswick.

For primary bibliographic entry see Field 03B.
For abstract, see .

W69-00707

ESTIMATION OF GROUND-WATER CONFIGURATION NEAR PAHALA, HAWAII USING ELECTRICAL RESISTIVITY TECHNIQUES,

Hawaii Univ., Honolulu.

Donald M. Hussong, and Doak C. Cox.

Water Resour Res Center Tech Rep 17, Aug 1967. 35 p, 12 fig, 1 tab, 57 ref. OWRR Project B-005-Hi.

Descriptors: *Ground water, *Water table, *Resistivity, Geophysics, Dikes, Saline water-fresh water interfaces, *Hawaii.
Identifiers: Kau, Hawaii.

In 1965 Water Resources Research Center, University of Hawaii, began development of necessary equipment to explore feasibility of an extensive resistivity exploration program. Subsequent funding permitted application of the technique toward solution of a ground-water problem in Paahala. A series of 14 electrical soundings was completed at Paahala, Sept 1966, to determine the extent and causes of an anomalous high water table. Four of the soundings indicated the limits of this underground reservoir to be at least 3500 ft east and 2500 ft south of a Maui-type well shaft. The southern extent of high head ground water suggests NE-SW trending of the eruptive fissure vent about 4000 ft SE of the well as a likely hydrologic barrier. Other soundings indicate intermediate water tables along the direction of the strike of the vent indicating a series of similarly trending dikes forming steps of water entrapment dropping toward the ocean. North of the hypothetical sequence, a set of somewhat confused soundings indicate what may be ancient buried soil or ash surfaces serving as impermeable boundaries presenting direct normal ground-water flow from Paahala SW above the dikes to the ocean south of Punaluu. (W69-00710)

SUBSURFACE FLOW IN A SOUTHERN ILLINOIS FRAGIPAN SOIL,

Illinois Univ., Urbana.

W. R. Boggess, and Elon S. Verry, Jr.

Water Resour Center Rep, Feb 1967. 51 p, 22 fig, 6 tab, 32 ref, append. OWRR Project A-009-Ill.

Descriptors: *Groundwater flow, Seepage, Soil moisture, Geology, *Perched water table, Illinois, *Subsurface flow.

Identifiers: Fragipan soil.

Based on plot determinations, subsurface flow provides a significant component of total water yield, comprising 29% of the direct runoff and about 1/5 of the total water, applied as artificial rainfall to plots whose soil moisture storage capacity was satisfied. Measurable subsurface flow lasted for 36 hr, followed by some dripping for an additional 12 hr. Such conditions occur during the winter and early spring when evapotranspiration is at a minimum. Subsurface flow in the Grantsburg and similar soil series is caused by a well-developed fragipan impeding downward movement of water in the profiles. Following recharge during the fall and winter, these soils may develop a perched water table, causing tillage difficulties if it persists into the spring months. The fragipan acts as a barrier to ground-water recharge by routing subsurface flow to stream channels, or to soil surface on severely eroded slopes. As a result, ground-water resources of the southern Illinois uplands are poor and streamflow is very low or nonexistent during the summer and fall. Towns away from main watercourses often depend on impoundments to provide water for their needs. Data indicate that from 1/3 to 1/4 of the direct runoff into such impoundments results from subsurface movement of water.

W69-00717

THE PRESENT AND FUTURE GROUND WATER SUPPLY OF THE BATON ROUGE AREA,

Louisiana State Univ., Baton Rouge.

Raphael G. Kazmann.

Louisiana Water Resour Res Inst, Tech Rep 2, Sept 1967. 36 p, 8 fig, 7 tab, 11 ref. OWRR Project B-001-La.

Descriptors: *Water supply, Economics, *Ground-water recharge, Legal aspects, Hydrogeology, Aquifers, *Encroachment, Estimated cost, Water management (Applied), Louisiana.

Salt water encroachment in the Baton Rouge aquifers may be reduced or stopped by decreasing the net offtake from each aquifer that must be protected. Replacement water is available from the alluvium of the Mississippi River. Amite or Comite Rivers can also supply all or part of the replacement water, either directly or through spreading grounds utilizing the water from one or both rivers. The cost of providing suitable water from the Mississippi alluvium would range from 7 cents/thousand gallons for treated domestic water to as little as 3 cents/thousand for aerated and filtered industrial water. The work now in progress will provide descriptions of alternative projects and water costs associated with each. Several phases of the multidisciplinary Baton Rouge study are described in detail, as well as preliminary results and the plans for the final phases of the work.

W69-00720

THE RECENT ALLUVIUM OF THOMAS AND DUNCAN POINTS,

Louisiana State Univ., Baton Rouge.

Joseph D. Martinez.

Louisiana Water Resour Res Inst, Tech Rep 1, June 1967. 24 p, 12 fig, 3 plate, 13 ref. OWRR Project A-004-La.

Descriptors: Geologic formations, *Aquifers, *Freshwater, Water supply, *Alluvium, Natural recharge, *Louisiana.

Available borings and reports concerning the Mississippi River alluvium near Baton Rouge, Louisiana, are examined and interpreted. Two particular areas, Thomas Point-Devil's Swamp and Duncan Point, contain sands which are potential sources of naturally-filtered river water. Due to the scarcity of reliable borings in the Thomas Point-Devil's Swamp area, subsurface data from nearby similar areas are extrapolated. Two of the 12 figures and 3 plates analyze the frequency of depths to top of the sand obtained from borings. At Duncan Point, the potential aquifer sand is estimated to

extend from -20 to below -200 feet mean sea level. Thomas Point, more difficult to interpret, probably has sand from -95 (possibly -65) down to -150 feet msl or lower. Additional borings are needed.
W69-00722

EFFECTS OF INDUCED STREAMBED INFILTRATION ON WATER LEVELS IN WELLS DURING AQUIFER TESTS,

Minnesota Univ., Minneapolis.

William C. Walton, and Earl A. Ackroyd.

Water Resour Res Center Bull 2, June 1966. 43 p, 21 fig, 4 tab, 25 ref. OWRR Project A-010-Minn.

Descriptors: *Surface-groundwater relationships, Influent streams, Rivers, Streambeds, Streamflow, Aquifers, *Artificial recharge, *Water table, Drawdown, Groundwater recharge, *Induced infiltration, *Analog computers, Permeability, Storage coefficient.

Electric analog computers, simulating streambed as an area of recharge with natural conditions, were used to appraise accuracy of estimated effects of induced infiltration on water levels based on image well theory. Electric analog computers for 2 aquifer test sites where field data were available were constructed. Selected aquifer tests involve 2 extreme aquifer-stream situations, i.e., where the cone of depression spreads beneath and beyond the entire streambed and where the cone of depression spreads only part way beneath the streambed. Analog computers consist of analog models and excitation-response apparatus. Analog models are scaled-down versions of aquifer-stream situations. During induced infiltration aquifer tests, the image-well theory closely describes drawdowns on land sides of streams with a high degree of accuracy. Drawdowns beneath or beyond the streambed and streambed areas of infiltration based on image-well theory are not observed in the field. However, streambed infiltration rates per foot of head loss based on hypothetical drawdowns computed with image-well theory seem empirically correct. Additional research recharge through streambeds partially penetrating aquifers and having finite widths, under varying stream-stage and water-level conditions is needed.
W69-00723

DEVELOPMENT OF DEEP MONITORING STATIONS IN THE PEARL HARBOR GROUND WATER AREA ON OAHU,

Hawaii Univ., Honolulu.

Doak C. Cox, and Chester Lao.

Water Resour Res Center, Tech Rep 4, March 1967. 32 p, 11 fig, 6 tab. OWRR Project A-011-Hi.

Descriptors: Water quality, Aquifers, Salinity, Wells, Water wells, Basalts, Test procedures, *Deep wells, *Sampling, pH, *Monitoring, *Groundwater, *Logging (Recording).

Identifiers: Hawaii, *Well logging, Well hydrograph, Oahu, Hawaii, *Puuloa Test Well, Hawaii, *Ewa Beach Test Well, Hawaii.

Two deep wells, one at Puuloa and the other at Ewa Beach in the Pearl Harbor area were drilled through the thick sedimentary cap into Koolau basalt, and have been readied for multiple-zone recording of water levels and water quality. Plastic pipes were lowered into the wells to selected depths determined by core composition and electric well logs. Gravel and beach sand were used selectively to backfill the wells. Thirteen sampling tubes were installed in the Puuloa well, and 7 sampling points were placed in the main well at Ewa Beach. A shallow auxiliary well was also drilled at Ewa Beach. Evidence from preliminary development of the deep aquifer at Ewa Beach indicates the possible existence of a thin layer of fresher water floating on water of nearly sea water composition. Water levels are being monitored in this aquifer and show a tidal efficiency of approximately 15%. The smaller sampling tubes are being developed at both sites.
W69-00729

DETERMINATION OF POROSITY AND PERMEABILITY OF SELECTED SANDSTONE AQUIFERS OF SOUTH DAKOTA,

South Dakota School of Mines and Technology, Rapid City.

John P. Gries, and David W. Niven.

Dep Geol Geologic Eng Rept, Feb 1967. 13 p, 4 fig, 1 tab, 5 ref, append. OWRR Project A-004-SDak.

Descriptors: *Porosity, *Permeability, *Confined water, Cores, South Dakota, Aquifers, *Sandstones, Sampling, Geology, Hydrogeology, Testing, Measuring instruments, Rock properties, Groundwater, Groundwater recharge.

Lower Cretaceous sandstones crop out continuously around the periphery of the Black Hills. These outcrops are believed to be the principal intake area for artesian water within these formations. Data on porosity and permeability were obtained from 376 cores cut by the investigators from outcrops along a 70 mi interval on the east flank of the Hills. Porosity and permeability were determined in the laboratory by means of a Ruska Porometer and a Ruska Permeameter. Permeability of Lakota Sandstone (202 cores) cut parallel to bedding ranged between 1.2 and 41,500 md, with a mean of 9115 md. Permeability perpendicular to bedding (35 samples) varied from 15.7 to 30,800 md, with a mean of 5683 md. Porosity of all 237 Lakota cores averaged 28.5%. Permeability of Fall River Sandstone (86) cores cut parallel to bedding ranged from 0 to 10,600 md, with a mean of 2052 md. Perpendicular to bedding (17 samples) ranged from 0.3 to 3622 md, with a mean of 793 md. Mean porosity of 103 Fall River cores was 23.9%. Mean values for 103 Newcastle Sandstone cores showed a permeability of 461 md, and a porosity of 19.6%. These outcrop figures are consistently greater than corresponding values reported from nearby deep oil and water tests.
W69-00734

OCCURRENCE OF NITRATE IN WELL WATERS,

Illinois Univ., Urbana.

T. E. Larson.

Water Resour Center, Proj 65-05G, June 1966. 15 p, 2 fig, 5 tab. OWRR Project A-005-III.

Descriptors: *Wells, *Nitrates, Chemical analysis, *Concentration, Deep wells, Shallow wells, Hazards, Livestock, Man, Farm wastes, Soil types, Field investigations, Illinois.

Purpose of this project was to study the occurrence of nitrate in well waters in Illinois by relating nitrate occurrence to well depth, to the source of the water, to the physiographic divisions of the state, and to the geographical location of the well. Selected locations within the state containing high nitrate concentrations were correlated with geographic information on soils and subsoils. The study shows that excessive concentrations of nitrate are more likely to be found in shallow wells than in deeper wells. Of the samples taken from shallow wells 23% contained 45 mg/l or nitrate. Excessive concentrations of nitrate are more likely to be found in drift wells than in limestone or sandstone wells. High nitrate concentrations were well scattered throughout the state except for 3 areas. Well construction is an important factor in the nitrate content of well waters. Any construction that allows surface water or water from a shallow depth to enter the well is more likely to contain excessive nitrate concentrations. No attempt was made to correlate nitrate concentration with soil types or with proximity to common sources of nitrate in farm wells such as barnyards, feedlots, manure piles, and septic tank fields.
W69-00741

RECORDS OF WELLS, WATER LEVELS, AND CHEMICAL QUALITY OF WATER IN THE LOWER SANTIAM RIVER BASIN, MIDDLE WILLAMETTE VALLEY, OREGON,

U. S. Geological Survey, Washington, D. C., Water Resources Division.

D. C. Helm.

Oregon State Eng Ground Water Rep No 13, May 1968. 186 p, 4 fig, 1 plate, 1 map, 4 tab, 8 ref.

Descriptors: *Data collections, *Hydrologic data, *Water wells, *Water levels, *Water quality, Oregon.

Identifiers: Santiam River Basin (Oregon).

Well records, water levels, and groundwater chemical analysis data are collected and compiled as part of a comprehensive hydrologic study of the Lower Santiam River Basin in the Middle Willamette Valley, Oregon. Water-level fluctuations are shown on hydrographs of 12 selected wells in the area. Records of 1,204 wells include 919 irrigation wells, 128 domestic wells, 53 industrial wells, 19 public supply wells, 10 institutional wells, 4 stock wells, 54 unused wells, 7 test wells, and 10 unclassified wells. Data for each well include type, use, year completed, depth, diameter, depth of casing, finish, depth to aquifer, aquifer thickness, character of aquifer, altitude and depth of water, pump, yield, drawdown, use, acres irrigated, and remarks. Drillers logs of 349 wells are compiled. Chemical analyses of water from 49 wells, 1 spring, and 5 rivers, and spectrographic analyses of water from 7 wells are reported. The standard analyses include silica, Fe, Mn, Ca, Mg, Na, K, bicarbonate, carbonate, sulfate, Cl, F, NITRATE, PHOSPHATE, B, As, TDS, hardness, pH, and color. Spectrographic analyses include Al, Be, Bi, Cd, Cr, Co, Cu, Ga, Ge, Fe, Pb, Mn, Mo, Ni, Ti, U, V, Zn, Beta activity, and Ra. (Knapp-USGS)
W69-00920

GROUND WATER RECHARGE AND ITS POTENTIAL,

Texas Technological College, Lubbock.

For primary bibliographic entry see Field 04B.

For abstract, see .

W69-00928

ARTIFICIAL RECHARGE THROUGH AUGMENTED BANK STORAGE,

Princeton Univ., N. J., Civil Eng Dept.

For primary bibliographic entry see Field 04B.

For abstract, see .

W69-00970

REMOVAL OF IRON AND MANGANESE FROM GROUND WATER,

Mississippi State Univ., State College, San. Eng. Dept.

Lloyd R. Robinson, Jr.

Prog Rep, Water Resour Res Inst, 1966. 29 p, 2 fig, 8 tab, 10 ref. OWRR Project A-003-Miss.

Descriptors: *Groundwater, *Iron, *Manganese, Aeration, Sedimentation, Filtration, Pilot plants, Chemical analysis, Water quality, Sewage treatment, Mississippi.

This paper is a progress report on research to determine factors involved in removal of iron and manganese from ground waters and to find ways of counteracting these interferences in the conventional treatment method of aeration, sedimentation, and filtration. The first phase has been to complete an initial screening and includes studies of available state records and contacts with local and state officials to locate problem spots in Mississippi. The second objective has been to construct and test pilot plant facilities to be used in making a detailed study of the problem of interferences with the removal of iron and manganese from ground water. The pilot plant has been so constructed that it can be used to study waters brought to, or synthesized in the laboratory, or taken to the field and operated at well-site. The final objective which has not been completed is to find a method satisfactory for analyzing large numbers of manganese samples collected during the latter phases of the study.
W69-00971

Field 02—WATER CYCLE

Group 2F—Groundwater

INSTRUMENTATION FOR SEISMIC EXPLORATION FOR GROUND WATER IN HAWAII,
Hawaii Univ., Honolulu.

For primary bibliographic entry see Field 07B.
For abstract, see .
W69-00974

EFFECTS OF SOLUBLE ORGANICS ON FLOW THROUGH THIN CRACKS OF BASALTIC LAVA,
Hawaii Univ., Manoa.

For primary bibliographic entry see Field 05B.
For abstract, see .
W69-00979

SOME SEISMIC TECHNIQUES FOR MAPPING SMALL SCALE SHALLOW STRUCTURES,

Hawaii Univ., Manoa.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-00985

ON THE SIMILITUDE OF DISPERSION PHENOMENA IN HOMOGENEOUS AND ISOTROPIC POROUS MEDIUMS,

Tahal, Water Planning for Israel Ltd., Tel Aviv.
Y. Bachmat.

Water Resources Res, Vol 3, No 4, pp 1079-1083, 1967. 5 p, 5 ref.

Descriptors: *Dispersion, *Solutes, *Porous media, *Model studies, *Hydraulic similitude, Analytical techniques, Groundwater, Groundwater movement, Darcys law, Laminar flow, Model Studies.
Identifiers: Peclet number.

A procedure of simulating, by means of a physical model, the dispersion of a solute in groundwater flowing through a homogeneous and isotropic aquifer is considered. Groundwater is a solution of variable density and viscosity owing to variations of solute concentration. The model has a very restricted application owing to the required simultaneous invariance of four nondimensional criteria of similitude: a macroscopic Reynolds number, a macroscopic Peclet number, the criterion of geometrical similarity of the medium, and the criterion of physicochemical similarity of the solution. However, at certain conditions, which are common in practice, some of those criteria can be waived, and the model becomes a useful device for the solution of field problems. These conditions occur in the range of validity of Darcys law (small Reynolds numbers), at relatively high Peclet numbers, and at very small variations of relative solute concentration (ideal solute). (Author)
W69-01042

A METHOD OF DETERMINING THE PERMEABILITY AND EFFECTIVE POROSITY OF UNCONFINED ANISOTROPIC AQUIFERS,
Technion Israel Institute of Technology, Haifa.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01044

ANALYSIS OF NON LINEARITIES IN GROUND WATER HYDROLOGY: A HYBRID COMPUTER APPROACH,
California Univ., Los Angeles.

For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01047

FACTORS AFFECTING GROUND-WATER RECHARGE IN THE MOSCOW BASIN, LATAH COUNTY, IDAHO,
Washington State Univ, Pullman.
Chang-lu Lin.

Pap, Dept of Geol, Sept 1967. 86 p, 31 fig, 7 tab, 39 ref. OWRR Project A-007-WASH.

Descriptors: *Groundwater basins, *Hydrogeology, Aquifers, Water table, Groundwater barriers, Groundwater movement, Idaho, Groundwater recharge, Natural recharge, Hydrologic cycle, Surface groundwater relationships, Geologic control.

The depleting ground-water reservoir reflected by long-term declines in the piezometric surface creates a critical problem in the Moscow basin. Results of climatological, hydrological, and geological studies indicate that low intensity of precipitation; (1) frozen ground; (2) high evaporation potential; (3) thickness, extent, and clay content of the Palouse loess and Latah Formation; (4) interflow zones; (5) fracture zones; and (6) the presence of ancient drainage channels are the primary factors affecting ground-water recharge in the basin. Fluorescent dye-dilution techniques have been used to detect stream losses near the margins of the plateau basalts. Results of these measurements verify other studies and indicate that this method is a sensitive tool in measuring the low flow of a stream. By applying this method, it can be shown that a portion of the surface flow joins the underflow in areas of low gradient and again rejoins the surface stream in reaches of steep gradient along Crumarine Creek. A portion of the underflow or component of surface flow eventually recharges the basin.
W69-01151

UNSTEADY UNCONFINED GROUNDWATER FLOW TOWARD A WELL,

Wisconsin Univ, Madison.
Willard A. Murray.
Pap, 1966. 19 p, 2 fig, 1 tab, 8 ref. OWRR Project A-005-WIS.

Descriptors: *Groundwater flow, *Wells, *Unsteady flow, Ground water, Computer programming, Aquifers, *Drawdown, *Water wells.
Identifiers: Pumping tests, Dupuit-Forchheimer idealiza.

The differential equation for unsteady unconfined radial flow to a well is solved by a numerical method on a digital computer. The application of the Dupuit-Forchheimer concept is the only simplifying assumption made. Analysis of results indicate that there is a substantial range of values for which the confined flow (Theis) solution is sufficiently accurate for use in problems involving unconfined aquifers. Graphical methods of solution are presented for determining aquifer characteristics and for predicting drawdown curves in unconfined aquifers.
W69-01153

GROUND-WATER HYDROLOGY OF THE MONOGAHELA RIVER BASIN IN WEST VIRGINIA,

U S Geological Survey.
Porter E. Ward, and Benton M. Wilmoth.
West Virginia Geol and Econ Surv, River Basin Bull 1, 54 p, 1968. 22 fig, 6 tab, 38 ref.

Descriptors: *Groundwater, *Water resources, *West Virginia, *Water yield, *Aquifers, Water quality, Water sources.
Identifiers: Monogahela River Basin (W. Va.).

Adequate supplies of groundwater are available in the Monogahela basin to meet present and future requirements. The best sources are wells in bedrock, particularly in sandstone. The most favorable areas are underlain by rocks of the Pottsville Group, Allegheny Group, Greenbrier Limestone, and the Pocono Formation. Yields of 50-350 gpm are common in most areas. The Dunkard Group yields only about 21 gpm; development of water supplies in its outcrop area is difficult, requiring intensive investigation and test drilling. Alluvium is too thin and areally restricted for large groundwater development. Water quality is generally good, with high iron, hardness, and hydrogen sulfide concentration in a few places. Some salty water is found below 100-300 ft in the

western part of the basin. Some oilfield, municipal, household, and chemical pollution occurs in a few areas. Coal-mine acid pollution has a small effect generally, but in some populated areas it is a difficult problem. Descriptions of geologic units and their water-bearing properties are tabulated. Geology, water potential, and water quality are shown by maps. (Knapp-USGS)
W69-01179

RADIOMETRIC STUDIES OF THE FLORIDAN AQUIFER: PROJECT COMPLETION REPORT, (CHAP) B--U-234/U-238 DISEQUILIBRIUM AS AN AID TO HYDROLOGIC STUDY OF THE FLORIDAN AQUIFER,

Florida State University, Department of Geology, Tallahassee.

M. E. Kaufman, H. S. Rydell, and J. K. Osmond.
U S Office of Water Resources Research, Washington, D C, pp B1-B5, July 1968. 5 p, 1 fig. OWRR Project A-005-Fla.

Descriptors: *Uranium radioisotopes, *Tritium, *Tracers, *Water sources, *Karst, Movement, Water circulation, Radiochemical analysis, Florida.
Identifiers: Floridan aquifer.

Uranium disequilibrium studies of the waters of the Floridan aquifer in north Florida suggest the possibility of using the study of natural fractionation of uranium isotopes to aid in hydrologic investigations. Analysis of the relations between the isotopic distribution patterns and the hydrologic flow system indicates the following: (1) Artesian waters exhibiting large negative departures from equilibrium (U-234/U-238 ratios: 0.50 to 0.96) underlie the Woodville Karst Plain and parts of the sinkhole-ridged Tallahassee Hills, interpreted as areas of recharge, high permeability and rapid circulation of groundwater. To account for the low isotopic ratios observed in these waters, it is hypothesized that Pleistocene leaching occurred, resulting in preferential removal of U-234. (2) Artesian waters with U-234/U-238 ratios near equilibrium are associated with Gulf Trough, interpreted as an area of low permeability and restricted groundwater circulation, with little Pleistocene leaching. A hydrologic barrier preventing any significant present southeastward movement of groundwater across the Gulf Trough is suggested. A tritium study of the Florida aquifer shows promising preliminary results but is as yet incomplete.
(Author)
W69-01181

PHASE I TEST WELLS, WHITE SANDS MISSILE RANGE, DONA ANA COUNTY, NEW MEXICO,

U S Geol Surv, Albuquerque, N Mex.
Gene C. Doty.
U S Geol Surv open-file rep, 39 p, July 1968. 12 fig, 11 tab, 2 ref.

Descriptors: *Water supply, *Water wells, *Exploration, New Mexico, Hydrologic data, Aquifers, Chemical analysis, Data collections, Water yield, Logging (Recording).

Identifiers: White Sands Missile Range (New Mexico), Test holes.

To explore the water-producing potential of the south-central part of White Sands Missile Range, 5 test wells were drilled in 1966 and 1967. Samples were collected and described, electric logs were made, and water samples were collected and analyzed. Small-yield (5-10 gpm) wells can be drilled in the fractured igneous rocks near surface drainage channels. Storage is small and wells may not be dependable. Wells in an alluvial fan should yield several hundred gpm of potable water containing 200 ppm sulfate. Bolson deposits have transmissibilities of about 20,000 to 295,000 gpd per ft. Water quality varies markedly with depth; specific conductance at 352 ft was 1,490 micromhos and at 635 ft, 61,000 micromhos. Sample descriptions, drillers' records, and chemical analyses are tabulated. Copies of commercially

made electric and radiation logs are included. (Knapp-USGS)
W69-01186

THE APPLICABILITY OF DARCY'S LAW, Purdue Univ., Lafayette, Indiana.

Dale Swartzendruber.
Soil Sci Soc of Amer Proc, Vol 32, No 1, pp 11-18,
Jan-Feb 1968. 8 p, 6 fig, 1 tab, 36 ref, 1 append.
OWRR Project A-004-Ind.

Descriptors: *Darcys law, *Kinetics, *Saturated flow, *Unsaturated flow, Velocity, Porous media, Clays, Diffusivity, Infiltration.
Identifiers: Nonproportional flow, Non-Darcian flow laws.

Deviations from Darcian proportionality between flow velocity v and hydraulic gradient i are considered in terms of a gradient-dependent hydraulic conductivity $K(i) = v/i$. Published data for saturated flow indicate measured variations in $K(i)$ of 2- to 4-fold, with a potentiality for 5- to 15-fold variations inferred from fitted non-Darcian flow equations. Non-Darcian effects for 2-dimensional radial flow are also analyzed. The hydraulic head distribution is shifted from the Darcian-derived logarithmic pattern toward the characteristic linear distribution for 1-dimensional flow, and the amount of the shift is velocity dependent. This implies that the flow net changes with flow velocity, and that the high-gradient flow regions are more permeable than for Darcian flow. The soil-water diffusivity D for some unsaturated soils appears to be gradient-dependent quantity. A maximum 8-fold variation in D is associated with a 40% discrepancy between experimental water-absorption rates and those calculated from proportional flow theory. Similarly, a 115% discrepancy in the rate of infiltration into a mixture of quartz sand and ground silica can be precisely accommodated with a non-Darcian infiltration equation derived by a simplified analysis. (Knapp-USGS)
W69-01188

GROUND-WATER EXPLORATION IN THE BOSQUE DEL APACHE GRANT, SOCORRO COUNTY, NEW MEXICO,

U S Geol Surv, Albuquerque, N Mex.
James B. Cooper.

U S Geol Surv open-file rep, 79 p, Aug 1968. 12 fig, 14 tab, 4 ref.

Descriptors: *Water supply, *Water wells, *Exploration, New Mexico, Hydrologic data, Aquifers, Chemical analysis, Data collections, Water yield.
Identifiers: White Sands Missile Range (New Mexico), Socorro County (New Mexico), Test holes.

Test drilling along the Rio Grande in the Bosque del Apache Grant in Socorro County, New Mexico shows that the area is hydrologically complex and that the quality of the groundwater varies from saline to fresh within short distances both laterally and vertically. Nearly all of the riverside land in the Grant is occupied by the migratory waterfowl refuge of the Bosque del Apache National Wildlife Refuge. Potable and near-potable water is obtained from 12 wells that tap sand and gravel, and the wells are capable of yielding 1,000 gal per minute or more. Stallion Range Center, a military installation on the White Sands Missile Range, about 15 miles east of the waterfowl refuge, needs about 100,000 gal per day of potable water, which is not known to be available at a location closer to the Center than the refuge area. Between 1963 and 1967, 7 test wells were drilled, and a suitable location for a supply well was found. The well would be about 250 ft deep and would tap a body of potable water that is about 100 ft in thickness. It is thought to underlie an area of at least 5 sq miles. Diagrammatic sections show the lateral and vertical relation of waters of different quality along the Rio Grande in a part of the Bosque del Apache Grant. Basic data in tables include records of 7 test wells, 12 high-yield supply wells, and 32 chemical analyses of groundwater from the wells. (Knapp-USGS)
W69-01189

EFFECT OF INCREASED PUMPING OF GROUND WATER IN THE FAIRFIELD-NEW BALTIMORE AREA, OHIO—A PREDICTION BY ANALOG-MODEL STUDY,
U S Geol Surv., Washington, D. C., Water Resources Div.
Andrew M. Specker.
U S Geol Surv Prof Pap 605-C, pp C1-C34, 1968. 34 p, 23 fig, 1 tab, 15 ref.

Descriptors: *Water resources, *Groundwater, *Analogs, *Induced infiltration, *Alluvium, Pumping, Transmissivity, Safe yield, Drawdown, Ohio.

Identifiers: Great Miami River (Ohio), Cincinnati (Ohio), Fairfield (Ohio), Well interference.

Analysis of the groundwater availability of the Great Miami River Valley train aquifer near Fairfield, Ohio by electric analog model has been undertaken to study the hydrologic feasibility of Cincinnati's proposal to enlarge its well field. The 32 sq mi study area is underlain by a sand and gravel aquifer with a transmissibility of about 400,000 gpd per ft. The 2 mi wide aquifer is bounded on both sides by rock of low permeability. Total pumping is 23 mgd. Recharge by induced stream infiltration is 325,000 gpd per acre of streambed. The model study indicated that a pumping rate of 40 mgd at the proposed well field can be sustained in addition to present pumping. Interference should not exceed 9 ft after 10 yr and total drawdown should not exceed 30 ft. A total pumping rate of 84 mgd from the aquifer is feasible. (Knapp-USGS)
W69-01192

2G. Water in Soils

HYDRODYNAMICS OF GEOPRESSURE IN THE NORTHERN GULF OF MEXICO BASIN,
U S Geological Survey, Baton Rouge, Louisiana.
Paul H. Jones.
Soc of Petrol Eng of AIME, No SPE 2207, 12 p, 1968. 2 tab, 39 ref.

Descriptors: *Osmotic pressure, *Infiltration, *Earth pressure, *Clays, *Pore pressure, Compaction.

Identifiers: Geopressure, Gulf Coast Area.

Pore water is trapped by rapid deposition of deltaic, inner neritic, and middle neritic sand and clay and by growth faulting in the Gulf marginal belt of subsidence. It is expelled rapidly with compaction and moves out through clay beds. Water expelled from the reservoir through clay beds is purified by hyperfiltration, and dissolved solids in remaining water are concentrated until osmotic pressure opposing the flow equals the lithostatic head differential. Consequent restriction of upward water loss increases reservoir temperature; this promotes early diagenesis of montmorillonite, which increases appreciably the volume of free pore water available to the reservoir. The molecular forces of osmotic pressure reduce the effective permeability of clay beds to zero, so that in many places geopressure has been preserved for millions of years. (Knapp-USGS)
W69-00923

THE ADAPTABILITY OF AN EXACT SOLUTION TO HORIZONTAL INFILTRATION,
Cornell University, Ithaca, New York.
Wilfried Brutsaert.
Water Resources Res, Vol 4, No 4, pp 785-789, Aug 1968. 5 p, 3 fig, 1 append, 12 ref.

Descriptors: *Infiltration, Porous media, Seepage, Soil, Moisture, Permeability, Darcys law, Capillary conductivity.

Identifiers: *Flow equations, Horizontal infiltration.

A mathematical solution is provided for the concentration-dependent diffusion equation. The equation is shown to be adaptable to the problem of horizontal infiltration, a phenomenon of one-dimensional flow in a partly saturated porous medi-

um, by a suitable approximation of algebraic functions describing the moisture content capillary suction and the moisture content-capillary conductivity relationships. One of the theoretical results that compares favorably with published experimental data gives the cumulative infiltration as a simple power function. Specific equations are derived and calculations are plotted. (Llaverias-USGS)
W69-00927

BASIC WATER RESEARCH ON NEW ENGLAND SOILS,

Maine University, Orono.

R. V. Rourke, and C. Beek.

Project Completion report. Rep of Office of Water Resources Res, Maine Univ, 3 p and 98 p in attach, June 1968. OWRR Project A-001-Me.

Descriptors: *Data collections, *Soils, *Maine, *Hydraulic conductivity, Soil chemical properties, Soil physical properties, Soil water, Organic matter, Permeability, Retention, Soil water movement, Particle size, Soil density, Acidity, Alkalinity. Identifiers: *Soil moisture reaction, *Percolation rate.

The physical hydrologic, and chemical characteristics of 8 Maine soils sampled at 5 locations each are collected and tabulated to aid in interpretation and use of soil maps for urban planning, industrial development, agricultural development, domestic waste disposal, and other uses. The characteristics measured and tabulated are organic carbon, moisture retention, water movement, particle size distribution, volume of coarse fragments, bulk density, soil reaction, exchangeable bases, and exchangeable acidity. Water retention was determined for several soil pressures and available moisture in each horizon was reported in inches of water per inch of soil. Saturated hydraulic conductivity was measured on many cores. The ability to receive septic sewage was evaluated by percolation rate tests. (Lang-USGS)
W69-00929

THE INFILTRATION OF IRRIGATION WATER INTO THE SOIL,

Mississippi State University, State College.

James B. Allen, William R. Fox, and Chi-Tong Chang.

Water Resources Res Inst, Completion Report. Miss State Univ Water Resources Res Inst, July 1968. 6 fig, 4 tab, 20 ref. 41 p, OWRR Project A-022-Miss.

Descriptors: *Irrigation, *Infiltration, *Irrigation efficiency, *Computer programs, *Mathematical models, Digital computers, Furrow irrigation, Mississippi.

Identifiers: *Antecedent moisture, Optimum efficiency.

The literature of soil water infiltration in furrow irrigation was reviewed and mathematical models of infiltration were established. The models were written in 4 FORTRAN IV programs for the IBM 360. A numerical example is presented to illustrate the effect of rate, duration, and interruption of inflow on irrigation efficiency. The results of the numerical example suggest that intermittent application of water can result in less runoff losses at some sacrifice in uniformity of application. (Knapp-USGS)
W69-00932

EXPERIMENTAL EVALUATION OF INFILTRATION EQUATIONS,

American Society of Agricultural Engineers, Utah State University, Logan.

R. W. Skaggs, F. F. Huggins, and E. J. Monke.

Paper presented at 1968 Ann. Meeting ASAE, Utah State Univ. Amer Soc of Agr Eng, Pap No 68-215, June 18-21, 1968. 6 fig, 3 tab, 24 ref, June 1968, 21 p, OWRR Project A-00-Ind.

Field 02—WATER CYCLE

Group 2G—Water in Soils

Descriptors: *Infiltration, *Equations, *Rainfall-runoff relationships, *Simulated rainfall, Model studies, Vegetation effects, Regression analysis.
Identifiers: Infiltration equations.

An analysis of infiltration equations proposed by Green and Ampt, Horton, Phillip, and Holtan was made on the basis of experimental data obtained in erosion studies with a plot sized rainfall simulator. An overload flow analysis was used to determine the infiltration - time relationship from the runoff hydrograph. Regression fits of the four equations to experimental data for 52 tests on 13 soils showed that all of the equations adequately described the infiltration rate - time relationship. Values obtained for the equation for each run analyzed are tabulated. (Author)
W69-00934

EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,

Clemson University, Clemson, S C. Agricultural Engineering Department.

James T. Ligon.

Amer Society of Agr Eng 1968 Annu Meeting, Utah State Univ., Logan, June 18-21, 1968, Paper No 68-220, 1968. 28 p, 10 fig, 1 tab, 15 ref. OWRR Project A-003-SC.

Descriptors: *Soil moisture meters, *Gamma rays, *Research and development, *Instrumentation, Calibrations.
Identifiers: Gamma ray transmission measurements.

The use of the gamma-ray transmission technique for measuring soil moisture in situ is evaluated. The method has considerable potential, particularly near the soil surface and near significant interfaces. Drift of electronic equipment and the apparent temperature sensitivity of the portable equipment limit present field utility, but techniques to minimize errors are presented. Theory for the determination of moisture changes between observations without prior knowledge of soil density was developed. Field data showing amounts and distribution of soil moisture changes due to infiltration, drainage, and evapotranspiration were obtained in a field test using 5 sets of access tubes during the 1967 growing season at Clemson, S C. (Knapp-USGS)
W69-00936

SOIL MOISTURE AND SOIL TEMPERATURE CHANGES WITH THE USE OF BLACK VAPOR-BARRIER MULCH AND THEIR INFLUENCE ON PINEAPPLE,

Hawaii Univ., Manoa.

Paul C. Ekern.

Water Resour Res Center, Rep 3, Aug 1967. 7 p, 4 fig, 4 tab, 16 ref. OWRR Project A-008-Hi.

Descriptors: *Mulching, *Crop response, *Evapotranspiration, *Soil water, Micrometeorology, Moisture availability, *Lysimeters, Equipment, *Soil temperature, Consumptive use, Water utilization, Water requirements, Evaporation, Fine textured soil, Tensiometer.
Identifiers: *Pineapples.

As mulching practice in pineapple culture in Hawaii has developed over the last 50 yr, a number of functions have been assigned to the action of the mulch. This study gives primary consideration to effect of soil moisture and soil temperature changes upon pineapple growth. Soil moisture changes were determined from field samplings and lysimeter studies at Wahiawa, Oahu. Changes in the soil moisture budget with the mulch were so slight that the variability of field sampling precluded assessment without excessive replication. Coefficients of variability for samples taken at the plant butt were 3 to 5% of a moisture constant (e.g., 15-bar point) for a soil series or within a single field. Moisture use, measured by semicontained hydraulic lysime-

ters, was reduced by the mulch when the soil was very wet but changed little when soil moisture ranged from field capacity (0.15-bar) to the 15-bar points. The mulch raised the average soil temperature about 1.6°C during winter. The measured 1/3 increase in plant growth was nearly identical with the increase calculated from growth-response of pineapple to temperature.
W69-00984

WATER VAPOR DIFFUSION IN RELATIVELY DRY SOIL: IV. TEMPERATURE AND PRESSURE EFFECTS ON SORPTION DIFFUSION COEFFICIENTS,

Dept of Agriculture, Tempe, Arizona, Water Conservation Laboratory.

Ray D. Jackson.

Soil Sci Soc of Amer, Proc, Vol 29, pp 144-148, 1965. 5 p, 6 fig.

Descriptors: *Arid lands, *Water vapor, Soils, Fine-textured soils, *Temperature, Gravimetric analysis, Gases, Liquids, *Diffusion, Monomolecular films, Movement, Thin films, *Water transfer, Equations, Pressure.
Identifiers: Coarse-textured soils, *Aridsoils.

Total diffusion coefficients measured at four pressures were used to calculate vapor and liquid diffusion coefficients for dry soils. Data indicated that the temperature dependence of water movement in thin films (water contents above a monolayer) was only slightly greater than the temperature dependence of bulk flow of water in soils. Water transfer in relatively dry soils occurred in both liquid and vapor phases. In coarse-textured soils vapor diffusion with the associated evaporation-condensation process was the predominant mechanism, while liquid diffusion was negligible. In fine-textured soils, diffusion in thin water films and along particle surfaces was appreciable. Determination of water vapor diffusion in relatively dry soil is important from the standpoint of the vast areas of dry soil that occur in arid regions of the world. (Blecker-Ariz)
W69-01018

A SENSOR FOR WATER FLUX IN SOIL 'POINT SOURCE' INSTRUMENT,

Commonwealth Scientific and Industrial Research Organization, Div. of Land Research, Canberra (Australia).

For primary bibliographic entry see Field 07B.
For abstract, see .
W69-01050

INFILTRATION BENEATH A FOREST FLOOR,

Washington Univ., Seattle.

Robert G. LaRock.

Tech Rep 21, Dep Civ Eng, Feb 1967. 23 p, 10 fig, 1 tab, 9 ref. OWRR Project A-001-WASH.

Descriptors: Hydrology, *Infiltration, Percolation, *Soil moisture, Moisture content, Lysimeters, Moisture tension, Hysteresis, Rainfall, Measuring instruments, *Forests.

Using a tension lysimeter system, tensiometers and a soil moisture neutron probe, moisture characteristics of a glacial outwash soil were determined during periods of soil moisture flow resulting from rainfall. In the flow range from zero, with soil at field moisture capacity, to 0.2 in./hr a change of 3% was observed in the soil moisture, and a change of 25 cm in tension. At a depth of 16-in. lateral flow was found during periods of rapid soil moisture flow, in spite of the coarseness of soil texture. It is presumed that this lateral flow was due to the gradual increase in coarseness with depth in the top 2 ft of this soil. Hysteresis characteristics of the soil were determined at depths of 16 and 74 in. The increase in coarseness in the surface 2 ft partially inhibited unsaturated water percolation, causing a wetter-when-wetting moisture-tension hysteresis at the 16-in. depth. A textural boundary at the 14-in. depth of coarse over finer material caused no distinct hysteresis effect.
W69-01150

MECHANICS OF BANK SEEPAGE IN NATURAL STREAMS DURING FLOOD FLOWS,

Nebraska Univ, Lincoln.

Alexander R. Peters.

Water Resour Res Inst Rep, Jan 1968. 26 p, 13 fig, 7 ref. OWRR Project A-006-NEB.

Descriptors: *Banks, Piezometers, Permeability, Time, Soil moisture, Porous materials, *Bank storage, *Seepage, *Groundwater flow, Sands, Porosity, Hydrology, Laboratory tests, Fluid flow.
Identifiers: *Permeability coefficients, Storage coefficients, Darcys law, Transmissivity, Compressibility.

The mechanics of bank seepage have been investigated by studying the characteristics of oscillatory fluid motion in porous media. Of particular interest was the way fluid is stored and given up by the porous medium. The purpose of this theoretical and experimental program was to obtain a better understanding of flow phenomena inside the soil. The various parameters affecting permeability were considered in order to determine the amount of flow stored during 1 cycle of a stream oscillation. Experiments were conducted using a two-dimensional watersand reservoir with 3 kinds of sand and various amplitudes and periods of oscillation. The coefficients of permeability, storage, porosity, and compressibility were determined and were incorporated in the evaluation of the experimental data.
W69-01163

2H. Lakes

THE CONTINUOUS PLANKTON RECORDER--A REVIEW OF THE LITERATURE,

Minnesota Univ., Minneapolis.

For primary bibliographic entry see Field 07B.

For abstract, see .
W69-00740

INHERENT AND MAXIMUM MICROBIOLOGICAL ACTIVITY IN SMITH LAKE,

Alaska Univ., College.

S. Burton.

Inst Water Resour Rept, 1968. 8 p, 1 tab. OWRR Project A-004-Alas.

Descriptors: Nitrogen, Microorganism, Arctic, Kinetics, Enzymes, *Azotobacter, Nitrogen cycles, Biological properties, Cold resistance, Limnology, Lakes, Aquatic environment, *Nitrogen fixing bacteria, Aerobic bacteria, *Aerobic bacteria.
Identifiers: Smith Lake, Alaska.

An examination of the microorganisms catalyzing chemical changes in a sub-Arctic lake was made to augment current knowledge of the nutrient cycles in the near Arctic. Several unusual nitrogen fixing species using nitrogen 15 experiments were isolated. Their characteristics were such that they could not be placed in the genera Azotobacter or other known genera. A number of psychrophiles were also isolated and classified. Studies of the enzyme tryptophane synthetase were conducted to compare enzymatic activities of psychrophiles and organisms growing at more usual temperatures. No unusual kinetics were determined.
W69-00744

EYES ON THE VOLTA LAKE, GHANA,

California Institute of Technology, Pasadena.

Jeffrey Ram.

New Sci, Vol 39, No 614, pp 540-541, Sept 12, 1968. 2 p, 1 map.

Descriptors: *Limnology, *Reservoir stages, *Succession, *Aquatic environment, Biological properties, Fish, Aquatic weeds, Chemical properties, Physical properties, Stratification.
Identifiers: Ghana, Volta River.

The changes in aquatic environment caused by filling a 3,200 sq mi lake on the Volta River in Ghana are being studied under the direction of the Volta Basin Research Project. Such studies are

vital for the development of water resources, fishing industry, and for weed control. The data which are being collected include commercial fish catch changes, insect population changes, weed growth, physical and chemical quality, and stratification of lake water. (Knapp-USGS)
W69-00931

THE ECOLOGICAL SIGNIFICANCE OF CELLOLYTIC BACTERIA IN QUABBIN RESERVOIR,
Clark Univ., Worcester, Mass.
John T. Reynolds.
Proj Completion Rep, Jan 1968. 11 p. OWRR Project A-007-Mass.

Descriptors: *Ecology, Bacteria, Algae, Phytoplankton, *Lakes, *Cellulose, Distribution patterns, Membrane processes, Massachusetts.

Ecological significance of cellulolytic bacteria in a large reservoir in central Massachusetts was studied. Bacteria were enumerated using membrane filter techniques: cellulolytic forms were grown out on a modification of Sanborn's China blue-cellulose dextrin agar, and heterotrophs on a mineral salt-mud extract agar and on MPH agar. Suspended cellulose and hemicellulose were concentrated by filtration and estimated by spectrophotometric determinations after treatment with phenol and sulfuric acid. Algae were enumerated and typed using standard procedures, and estimates of the amounts of cellulose produced by the phytoplankton observed were made after determinations of the amounts of cellulose present in known concentrations of algae representative of the types found in the reservoir. Total numbers of bacteria varied between less than 1 per ml of sample to a high of 170 per ml of sample. Presumptive cellulolytic bacteria accounted for from less than 0.5 to 52% of the total bacterial populations measured in several different areas before, during and after an algal bloom. Numbers of presumptive cellulolytic bacteria appear to have no consistent relation with estimates of amounts of cellulose. Estimates of cellulose content of the water varied between 360 to 2750 micrograms per liter of sample.
W69-00976

A MOBILE LIMNOLOGICAL LABORATORY,
Minnesota Univ., Minneapolis, Limnological Res Ctr.
Robert O. Megard, and Joseph Shapiro.
J Limnol Oceanogr, Vol 11, No 3, pp 420-422, July 1966. 3 p, 5 fig. OWRR Project A-008-Minn.

Descriptors: *Limnology, Primary productivity, Chemical analysis, *Eutrophication, Data collections, Aquatic environment, Biomass, *Laboratory equipment.

In connection with the study of primary productivity in Minnesota lakes, a mobile limnological laboratory was constructed with most of the facilities of modern, well-equipped permanent laboratory. The laboratory is self-contained and can be operated in the field for weeks or months. It is heated and insulated, and has several alternate water and electrical supplies. Standard titrimetric and colorimetric analyses, as well as more sophisticated instrumental analyses, can be performed in field under conditions that compare favorably with conditions in a permanent laboratory. Storage space for limnological equipment and for sediment-coring apparatus is ample and easily accessible.
W69-00933

COMPUTATION OF THE COMPONENTS OF THE THERMAL BALANCE OF PLANNED RESERVOIRS,
L. V. Nesina.
Soviet Hydrol: Selec Pap, No 2, pp 183-189, 1967. 7 p, 4 fig, 2 tab, 13 ref. Translated from Trudy GGO, Main Geophys Observ, No 206, pp 31-37, 1967.

Descriptors: *Heat budget, *Reservoirs, Air temperature, Water temperature, Humidity, Wind velocity, Depth.
Identifiers: USSR, Reservoir thermal budgets.

A method of determining the components of the thermal balance of planned reservoirs is examined. The method is based on computations of the water surface temperature, air temperature and humidity, and wind velocity over the surface of the reservoir. Examples of the computation of the components of the thermal balance are given for reservoirs of various dimensions and depths, and the results of the computations are analyzed. (Author)
W69-01035

SURFACE CHLORIDE DISTRIBUTION IN MAINE LAKES,

Maine Dept. of Inland Fish and Game, Dry Mills Hatchery, Gray.
Donald F. Mairs.
Water Resources Res, Vol 3, No 4, pp 1090-1092, 1967. 3 p, 1 fig, 7 ref.

Descriptors: *Water quality, *Lakes, *Maine, Chlorides.

Chloride analyses on surface water samples collected from 126 Maine lakes demonstrate the generally acknowledged trend toward decreasing chlorides as distance from the coast increases. Some anomalous values are reported, about 1/2 of which are in hard water areas. The possibility is raised that highway salting in winter may affect surface chloride levels in Maine lakes. (Knapp-USGS)
W69-01051

EQUILIBRIUM SURFACE WATER TEMPERATURES,

Colorado State Univ., Fort Collins.
James LaVerne Hathaway.
M S Thesis, Colo State Univ, Fort Collins, 55 p, June 1968. 3 fig, 16 tab, 1 append, 54 ref. OWRR-A-006-Colo.

Descriptors: *Water temperature, *Heat transfer, Climatology, Heat budget, Evaporation, Convection, Radiation, Thermal pollution.
Identifiers: Surface water temperature.

A method of predicting the equilibrium surface water temperature of rivers and lakes under natural or thermally polluted conditions was developed. Heat transfer by evaporation, convection, radiation, and solar radiation are included in the development. A mass transfer coefficient was calculated using known mean monthly values for all parameters, obtained from a study of several rivers and a lake. The mass transfer coefficient was correlated empirically with mean monthly wind velocity, and appears to be a function only of wind velocity. Formulas are presented for trial and error calculation of surface water temperatures. (Knapp-USGS)
W69-01058

STRONTIUM ISOTOPE COMPOSITION AND TRACE ELEMENT CONCENTRATIONS IN LAKE HURON AND ITS PRINCIPAL TRIBUTARIES.

Ohio State Univ, Columbus.
Gunter Faure, Lois M. Jones, and Rene Eastin.
Rep 2, Dept of Geol, Aug 1967. 109 p, 21 fig, 20 tab, 28 ref. OWRR Project B-004-Ohio.

Descriptors: Geochemistry, Bedrock, Sedimentary petrology, Great Lakes, Mineralogy, Radioisotopes, Strontium radioisotopes, Lake Huron, Trace elements.
Identifiers: Bedrock composition.

Concentrations of the major cations: Na, K, Ca, and Mg and Sr were determined for 64 samples of surface water from Lake Huron and for 17 of its major tributary rivers. Isotopic compositions of strontium were measured for 30 samples of lake water and for 13 of tributary rivers. Concentrations of dissolved iron and total phosphorus were deter-

mined for a small suite of lake and river water. The data documents important differences in the chemical composition of water discharged into Lake Huron by Lake Superior, Lake Michigan and tributary rivers. These differences are related to differences in the chemical and mineralogical composition of the bedrock underlying the Great Lakes drainage basin. The strontium contributed to Lake Huron by water draining the Canadian Shield along its northern shore is enriched in radiogenic strontium 87. The average strontium 87/strontium 86 ratio is 0.718. The rivers draining sedimentary rocks of Michigan and SW Ontario contribute strontium whose isotope composition is similar to that in the modern oceans. A geochemical model is presented representing the chemical composition of water in Lake Huron.
W69-01139

THE KEWEENAW CURRENT, A REGULAR FEATURE OF SUMMER CIRCULATION OF LAKE SUPERIOR,

Wisconsin Univ, Madison.
Robert A. Ragotzkie.

Tech Rep 29, Univ Wisc, Aug 1966. 30 p, 18 fig, 2 tab, 9 ref, disc. OWRR Project A-004-WIS.

Descriptors: Bathythermographs, Distribution patterns, Isotherms, *Remote sensing, Current (Water), *Infrared radiation, Depth, Water temperature, Cross-sections, Thermocline, Circulation, Great Lakes, Lake Superior.

Identifiers: Keweenaw current, Lake currents, Keweenaw Peninsula (Mich.).

Infrared radiometer surveys of Lake Superior during the summer of 1964 and 1965 have shown that a band of warm water separated by a sharp thermal gradient appears along the north coast of the Keweenaw Peninsula in late June and persists at least into August. The subsurface thermal structure in this region indicates a steep slope of the geodynamic surface with the pressure gradient directed offshore. Calculation of current velocity based on the geodynamic slopes gives velocities up to one knot. Direct observations confirm the existence of this current both with regard to location and estimated velocity. The current, for which the name 'Keweenaw Current' is suggested, flows northeastward along the north coast of the Keweenaw Peninsula. It appears to be a boundary current and is probably maintained by the piling up of warm water along the south side of the lake by Ekman transport. It is shown that although the 'thermal bar' effect may exist in early June, this phenomenon does not provide an explanation for the temperature and circulation pattern observed later in the season. Analysis of infrared radiometer data at intersections of flight tracks on a single day gave diurnal heating rates of 0.21 to 0.27 deg C per hr. (Ragotzkie-Wisc)
W69-01152

21. Water in Plants

THE ANALYSIS OF THE UPTAKE OF WATER BY PLANT ROOT SYSTEMS,

Illinois Univ., Urbana, Agronomy Dept.
A. Klute.

Water Resources Center, Project 65-03G, Aug 1966. 38 p, 18 fig, 7 ref. OWRR Project A-003-III.

Descriptors: Analysis, *Plant (Botany), Theory, Water table, *Soil moisture, Water, Models, *Plants.
Identifiers: *Plant-water physics.

The flow equation for water in unsaturated soil may be written to include a source term which can be used to represent the uptake of water by roots of plants. The roots are considered to be distributed in the soil in a continuous manner and the use of water by roots is represented as a negative source. The objective of the research work described in this paper was to obtain solutions of the flow equation for soil water for various boundary conditions and to investigate the effect of the source term on

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the flow patterns. The choice of the source function was studied. Experiments were planned and started to obtain data for verifying the predictions made from the flow theory and to aid in the development of a model for the source function.
W69-00973

THE MECHANICS OF FLUID TRANSPORT IN VEGETATION, Massachusetts Univ., Amherst.

Denton B. Harris.
Proj Completion Rep, Feb 1968. 11 p, 3 fig, 2 tab, 10 ref, append. OWRR Project A-017-Mass.

Descriptors: Plants, *Flow, Pressure, Transpiration, Trees, Electric fields, Permeability, *Capillary action, Vegetation.

The cohesion theory of sap flow in vascular plants has been tested. Measurements of flow as a function of pressure drop indicate excessive negative pressure would be required for corollation between expiration rates and permeability in native species. Testing disproved diurnal variations in transpiring trees. Careful calibration indicates that measuring apparatus undergoes greater dilatation due to thermal change than does vegetation due to expiration. A search has been conducted for corollation between mass flow in vegetation and electric field potential. It has been shown that high intensity electric fields do have an effect on expiration rates in tomato plants. It has also been demonstrated that pressure induced flow in vascular plants produces an electric potential gradient. These results indicate atmospheric potential and/or biochemical potentials within the plant, may account for the driving forces for sap flow in vegetation. Further research should include microelectrometric surveys of living plant tissue. Gravimetric studies of expiration in electric fields should be undertaken at field intensities of between 200 and 500 volts per meter.
W69-01002

GROWTH AND YIELD OF SAGEBRUSHGRASS VEGETATION IN RELATION TO PRECIPITATION AND TEMPERATURE, Forest Service, Washington, D. C., Div. of Watershed, Recreation and Range Res.

J. P. Blaisdell.
Proj 9th Int Grassland Congress, Vol 1, pp 465-468, 1966. 4 p, 4 tab.

Descriptors: Arid climates, Sagebrush, *Precipitation (Atmospheric), *Temperature, Productivity, Range grasses, *Correlation analysis, *Weight, *Plant growth, Soil moisture, Climatic data, Growth rates, Crop production, Plant populations, Seasonal.
Identifiers: *Herbage.

The study was concerned with the growth of rangeplants, their year-to-year variations and the extent to which these variations are related to precipitation and temperature on the arid Upper Snake River Plains of Idaho. Correlation analysis was used to relate precipitation and temperature to herbage production. Correlations were based on data for 13 years. Herbage weight was fairly well correlated with precipitation of the 9 month period immediately preceding the growing season. Correlation coefficients between weight and annual precipitation for the period July 1 to June 30 were generally lower. Most of the plant growth in the locality was completed prior to June and the normal abundant precipitation during that month had little effect on current production. Precipitation during the growing season was rarely great enough to overcome a marked deficiency in soil moisture at planting time. (Blecker-Ariz)
W69-01008

DROUGHT TOLERANCE EVALUATION AMONG RANGE GRASS GENERA, SPECIES, AND AC-

CESSIONS OF THREE SPECIES USING PROGRAM-CONTROLLED ENVIRONMENT, Agricultural Research Service, Tucson. Crops Research Div.

L. N. Wright.
In affiliation with Arizona Univ, Tucson, Dept of Agronomy. Proc 9th International Grassland Congress, Vol 1, pp 165-169, 1966. 5 p, 1 fig, 3 tab.

Descriptors: *Drought tolerance, *Arid climates, Ranges, *Grasses, Germination, *Drought resistance, Seeds, Plant growth, Variability, *Plant breeding, Growth chambers.

Identifiers: *Seedlings, Survival, Reseeding, *Controlled environment.

A plant growth chamber was used to evaluate the six species, 43 accessions of blue panicgrass, 16 accessions of Boer lovegrass and 22 accessions of Eragrostis spp. for seedling drouth tolerance. Seeding survival data showed differences among accessions which reflect seedling drouth tolerance variability within a species, and further isolation of seedling drouth-tolerant plants within species would be expected. Results suggest that artificial seedling drouth tests can be used to isolate superior drouth-tolerant geno-types and in conjunction with other appropriate plant breeding techniques, to develop improved drouth-tolerant varieties. (Blecker-Ariz)
W69-01010

CONTRASTS AMONG CALANOID COPEPODS FROM PERMANENT AND TEMPORARY PONDS IN ARIZONA, Ariz. State Univ., Tempe. Dept. of Zoology.

Gerald A. Cole.
Am. Midland Naturalist. Vol 76, No 2, pp 351-368. Oct 1966. 18 p, 5 fig, 4 tab, 38 ref.

Descriptors: *Ponds, *Arizona, *Copepods, Plankton, Aquatic animals, *Ecotypes, Clutch, Eggs, Life cycles, Wet seasons.

Identifiers: Temporary ponds, Permanent ponds.

Thirty-seven samples of plankton from Arizona ponds contained calanoid copepods. Eighteen of these were classified as temporary, the remainder permanent habitats. In order of predominance, the species were Diaptomus albuquerqueensis; D. sicioides; D. clavipes; D. novamexicanus; D. sanguineus and D. nudus. The three predominating species were found in both waters, D. nudus occurred in one permanent and the remainder were found in temporary sites. Clutch sizes and cephalothorax lengths were greater in temporary ponds and there was a correlation between female length and number of eggs per clutch. (Affleck-Ariz)
W69-01025

SNOW CATCH BY CONIFER CROWNS, Washington State Univ., Pullman, and Forest Sci Lab, Moscow, Idaho.

Donald R. Satterlund, and Harold F. Haupt. Water Resources Res, Vol 3, No 4, pp 1035-1039, 1967. 5 p, 2 fig, 3 tab, 7 ref.

Descriptors: *Interception, *Conifers, *Snow, Idaho.

Identifiers: Autocatakinetic growth.

Study of interception storage of snow by 2 species of sapling conifers in northern Idaho revealed that cumulative snow catch follows the Law of autocatakinetic growth, or growth which is increased by the results of previous growth and would continue at an increasing rate without constraint. The ability of tree limbs to bear snow is the constraint of the system, and up to that point growth rate increases because snow bridges gaps in the foliage and constantly increases snowholding platform area. Interception storage followed predictions in 5 storms which began with trees bare and in 2 in which snow fell on trees already holding snow. In no storms was there marked deviation from the autocatakinetic law. (Knapp-USGS)
W69-01049

STUDIES OF CONSUMPTIVE USE OF WATER BY PHREATOPHYES AND HYDROPHYES NEAR YUMA, ARIZONA, U.S. Geological Survey.

Charles C. McDonald, and Gilbert H. Hughes. U.S. Geol Surv Prof Pap 486-F, pp Fl-F24, 1968. 24 p, 17 fig, 12 tab, 11 ref.

Descriptors: *Phreatophytes, *Consumptive use, *Evapotranspiration, Water table, Arizona, Bermudagrass.

Identifiers: Arrowweed, Quailbrush, Saltbrush.

Studies of the transpiration of several species of flood-plain vegetation, and evaporation from water surfaces and bare soil were carried out near Yuma, Ariz, during a 6-year period, 1961-66. Arrowweed, fourwing saltbrush, quailbrush, and bermuda grass were grown under controlled conditions in 1,000 sq ft tanks; cattail was grown in 100 sq ft tanks. Evaporation from water surfaces was measured by 2 standard U.S. Weather Bureau Class 'A' pans and by a 10 ft sq ground-level tank. The immediate areas had a moderately dense cover of preponderantly arrowweed, and the environment was principally desert, with high temperatures, low humidity, and a long growing season. Rates of evaporation and transpiration for this area are among the highest in the U.S. Annual consumptive use increased with the volume of vegetation, but the consumptive use per unit volume decreased as the plants approached maturity. Depth to the water table strongly influenced evaporation from bare soil; for water table depths of 2.4-0 ft, evaporation varied from 3 to 20 in. yearly. Arrowweed (*Plichea Sericea*) used an average of 96 in. of water yr, quailbrush (*Atriplex lentiformis*) 44 in., saltbrush (*Atriplex canescens*), 38 in., and bermuda grass (*Cynodon dactylon*) used 73 in. (Knapp-USGS) W69-01178

2J. Erosion and Sedimentation

PLANFORM ANALYSIS OF MEANDERING RIVERS, Purdue University, Lafayette, Indiana.

For primary bibliographic entry see Field 02E. For abstract, see .
W69-00917

THE USE OF STOCHASTIC MODELS IN STUDIES OF ALLUVIAL CHANNEL PROCESSES,
U.S. Geological Survey, Fort Collins, Colo.
Carl F. Nordin, and Everett V. Richardson. Int Ass for Hydraul Res 12th Cong Proc, Fort Collins, Colo, Sept 6-14, 1967, pp 96-102, 1967. 7 p, 2 fig.

Descriptors: *Statistical models, *Stochastic processes, *Markov processes, *Alluvial channels, Meanders, Sediment transport, River Systems.
Identifiers: Stochastic models, Poisson processes, Random walk, Branching processes.

Stochastic models can be used to describe either details of sediment transport phenomena or more general aspects of river channel morphology. The compound Poisson process and the random walk serve as models for the dispersion of sediment particles, and a linear second-order Markov process gives the essential statistical properties of the profile of a dune-covered bed. Branching processes and the theory of most frequent random walks find application as models for river networks and river meandering. For simple cases, models describing transport phenomena could be combined with the models of channel morphology to produce a more complete picture of alluvial channel processes. (Author)
W69-00937

THE SEDIMENT YIELD OF MAJOR RIVERS OF THE WORLD,
U.S. Department of Agriculture, Hyattsville, Maryland, Soil Conservation Service.
John N. Holeman.

Water Resources Res, Vol 4, No 4, pp 737-747, Aug 1968. 11 p, 7 tab, 30 ref.

Descriptors: *Sediment yield, *Erosion, *Runoff, *Sediments, Rivers, Earth-water interfaces, Sedimentation rates, Oceans.

Identifiers: *World rivers, *Water-borne sediments.

The measured and estimated sediment yield of the major world rivers are summarized, according to continents, drainage area, tons of sediment transported, and water discharge data. Africa, Europe, and Australia appear very low in sediment yield and average 70, 90, and 115 tons per sq mi each year, respectively. South America is low with 160 tons per sq mi; North America is moderate, with a value of 245. Asia is the high producer of sediment, with 1,530 tons/sq mi, which is equivalent to 80% of the sediment reaching the oceans yearly. These tabulated data pertain to more than one-third of the land contributing water-borne sediment to the seas and, if representative, indicate an annual world sediment yield of 20 billion tons (20×10^9 to the 9th power). (Llaverias-USGS)

W69-00941

RATE OF SOLUTION OF LIMESTONE IN THE KARST TERRANE OF FLORIDA, Florida Univ., Gainesville.

H. K. Brooks.

Water Resour Res Tech Completion Rep, Sept 1967. 16 p, 2 fig, 23 ref. OWRR Project A-004-Fla.

Descriptors: Aerial photography, Aquifers, Cavities, Erosion, Water quality, Permeability, Porosity, Water storage, *Stream erosion, Water table, Runoff, *Sinkholes.

Identifiers: Artesian system, Caverns, *Karst terrane.

Data are presented and examples cited to explain the rate and pattern of development of the solution features in the karst terrane of Florida. The overall rate of erosion is 1.5 in. per 1000 yr; the rate varies considerably depending upon the quantity and composition of the runoff influx. The early stages of the cycle have developed under artesian conditions with limited entry of surface water. Relatively low primary porosity and permeability have resulted in the circulation and solution being fracture controlled. Subsequent development and channeling of surface runoff into the aquifer results in solution of deep sinkholes, extensive caverns and the development of lake basins and prairies. Circulation of the nearly saturated water through the rock from pore to pore away from the solution cavities has resulted in high secondary porosity and permeability. In the open limestone plain under water table conditions solution is concentrated in the upper phreatic zone but not because of shallow lines of flow. With this theoretical model of the development of the porosity, permeability, and cavities in the Floridian aquifer the fracture traces evident on aerial photographs can be used to obtain the quantity and quality of water desired.

W69-00977

SEDIMENT SAMPLING: INSTRUMENTATION AND TECHNIQUES, Dept. of Agriculture, Oxford, Miss., Sedimentation Laboratory.

For primary bibliographic entry see Field 07B.

For abstract, see .

W69-01015

COMPUTATION OF THE GREATEST POSSIBLE DEPTH OF CHANNEL DEGRADATION, State Hydrological Institute, USSR.

N. S. Znamenskaya.

Soviet Hydrol: Selec Pap, No 2, pp 199-203, 1967. 5 p, 2 fig, 1 tab, 3 ref. Translation from Meteorologiya i gidrologiya, No 4, pp 80-84, 1967.

Descriptors: *Scour, *Stream erosion, *Forecasting, River beds, Dunes, Sand bars, Sand waves, Meanders.

Identifiers: USSR, Volga River, Amu Darya River, Syr-Darya River, Polomet' River.

A method is proposed for computing maximum expected scour at proposed engineering works in channels with dune-form beds. The height of a dune is a function of the ratio of scour to nonscour velocity and of stream depth. To verify the proposed relationship, computations were made and compared with measured depth of scour on the Volga, Amu Darya, Syr-Darya, and Polomet' rivers. In twenty-one comparisons, computations and measurements were within computed probability limits of depth of 10-1%. (Knapp-USGS) W69-01033

DISCHARGE OF SUSPENDED SEDIMENTS AS A FUNCTION OF HYDROLOGIC CHARACTERISTICS, N. N. Bobrovitskaya.

Soviet Hydrol: Selec Pap, No 2, pp 173-183, 1967. 11 p, 5 fig, 5 tab, 9 ref. Translation from Trudy GGI, No 141, pp 107-120, 1967.

Descriptors: *Sediment discharge, *Rivers, *Floods, Discharge (Water), Peak discharge, Hydrographs.

Identifiers: USSR, Polomet River, Flood Rise-sediment discharge relationships.

Mean annual suspended sediment discharge of the Polomet and other USSR rivers was investigated as a function of hydrologic characteristics, particularly of the rise of spring flood water. No unique relation between water discharge and sediment discharge was found. In most but not all stretches of the river sediment discharge was larger with rising than with falling water. The rate of rise of flood waters correlated strongly with sediment discharge, however. On a plot of sediment discharge against rate of floodwater rise the scatter was less than 30% all years except 1964, when it was 37%. Other rivers show generally similar relationships. (Knapp-USGS)

W69-01036

SPECIFIC DISCHARGE OF ENTRAINED SEDIMENTS, K. I. Rossinskii.

Soviet Hydrol: Selec Pap, No 2, pp 152-158, 1967. 7 p, 2 fig. Translation from Trudy GGI, No 141, pp 35-42, 1967.

Descriptors: *Sediment discharge, *Bed load, *Unsteady flow, Open channel flow, Velocity, Particle size, Particle shape, Roughness (Hydraulic), Probability.

Identifiers: USSR, Pulsating flow.

A formula is proposed for computing the discharge of bed load sediments under the influence of velocity pulsations. Discharge is a function of compactness of particle motion, defined as the ratio of instantaneous volume of moving particles to total volume of the layer in which motion occurs. Compactness is determined by particle shape, the degree to which the bottom surface is shielded from scour by roughness elements, and the proportion of time the pulsating flow exceeds threshold particle-displacement velocity. In the analysis presented, shape and roughness are treated as constant. The equations relate discharge to velocity for each particle size present in the sediment by use of Gaussian probability curves to estimate the part of the pulsating flow exceeding scour threshold. (Knapp-USGS)

W69-01037

A THERMODYNAMIC ANALOGY FOR MEANDER SYSTEMS, U.S. Geological Survey and Illinois Univ., Urbana.

A. E. Scheidegger.

Water Resources Res, Vol 3, No 4, pp 1041-1046, 1967. 6 p, 1 fig, 7 ref.

Descriptors: *Meanders, *Thermodynamic behavior, Statistical methods, Stochastic processes.

Identifiers: Thermodynamic analogy.

A thermodynamic analogy for meander systems can be set up such that analogs of temperature, entropy, and free energy can be defined, based on the statistical aspects of meander formation. Meanders seem to be related to the fact that a river has a finite probability to deviate from straight course, and the probability distribution of deviation is Gaussian. There is a great similarity between this statistical problem and an analogous one in the kinetic theory of gases. Solutions to gas dynamics problems can be used in solving problems of development of meander systems. (Knapp-USGS) W69-01048

INSECTICIDE ADSORPTION BY LAKE SEDIMENTS AS A FACTOR CONTROLLING INSECTICIDE ACCUMULATION IN LAKES, Wisconsin Univ, Madison, Wisconsin.

For primary bibliographic entry see Field 05G.

For abstract, see .

W69-01154

SPECULATIONS CONCERNING PALEOHYDROLOGIC CONTROLS OF TERRESTRIAL SEDIMENTATION, Colorado State Univ, Fort Collins, and U. S. Geological Surv, Washington, D.C.

S. A. Schumm.

Geol Society of Amer Bull, Vol 79, No 11, pp 1573-1588, Nov 1968. 20 p, 1 tab, 4 fig, 5 photo, 63 ref.

Descriptors: *Paleohydrology, *Hydrologic data, *Sedimentation rates, *Vegetation effects, Cenozoic Era, Sediment load, Channel morphology, Climatology.

Identifiers: *Terrestrial sedimentation, Phytologic data, Speculations.

A variety of hydrologic data and geomorphic observations were reviewed and used to speculate on the changes in the hydrologic cycle, river morphology, and fluvial sedimentary deposits during geologic time. Prior to significant vegetal cover, denudation and runoff rates were high and floods were large, and coarse sediments were spread as sheets over piedmont areas. With appearance of terrestrial vegetation and its colonization of the land surface, erosion rates decreased, as did runoff and flood peaks. Alluvial deposits became stabilized, but large floods caused periodic flushing of sediment from the system, thereby creating sedimentary cycles of deposits. The influence of climate change on volume and type of sediment moved from an erosional system became more pronounced as the effect of vegetation on the hydrologic cycle increased. As grasses developed during the Cenozoic Era the relations between climate, vegetation, erosion, and runoff became like today except for man's influence. Diagrams, graphs, and photos show hypothetical series of rainfall-runoff relationships during geologic time and bed-load and suspended-load stream channels of today. (Lang-USGS)

W69-01164

OCCURRENCE OF POOLS AND RIFFLES: AN ELEMENT IN THE QUASI-EQUILIBRIUM STATE OF RIVER CHANNELS, Western Ontario Univ, London, Ontario, Canada.

Raymond K. Dolling.

Ontario Geogr, No 2, pp 3-11, 1968. 9 p, 2 fig, 2 plate, 3 tab, 7 ref.

Descriptors: *Streambeds, *Channel morphology, *Energy losses, *Statistical methods, *Regression analysis, Manning's equation, Depth, Roughness (Hydraulic), Velocity.

Identifiers: Pools and riffles.

A sequence of 15 pools and 15 riffles on Bronte Creek, Ontario, was studied to determine objective criteria to be used to distinguish pools and riffles and to determine their relation to energy distribution in the stream. The dimensionless

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velocity/depth ratio was chosen for use in the analysis because it is easily determined and it may easily be compared with values from other areas. It is subjectively apparent that low values of velocity/depth correlate with pools, and high values with riffles. A multiple regression analysis was made with velocity/depth as the dependent variable and slope/width and roughness as independent variables. The predictive value of the independent variables is 96%. The model fails to explain the relation of power expenditure in pools and riffles because it does not include water surface slope as a variable. To explain scour in pools it is subjectively evident that high flows, slope in pools must be greater than over riffles, so that equal energy is expended in each. (Knapp-USGS)
W69-01166

PRELIMINARY APPRAISAL OF STREAM SEDIMENTATION IN THE SUSQUEHANNA RIVER BASIN,

U.S. Geol Surv, WRD.

K. F. Williams, and J. R. George.

U.S. Geol Surv open-file rep, 49 p, Mar 1968. 11 fig, 6 tab, 31 ref.

Descriptors: *Sedimentation, *Reservoir silting, *Pennsylvania, Particle size, Sediment yield, Provenance, Mining, Farms.

Identifiers: Susquehanna River Basin.

Analyses of stream-sediment discharge measurements collected in the Susquehanna River basin up to October 1965 are used to describe the sediment yield of major tributaries. The Susquehanna carries 110 tons of sediment per sq mi of its drainage basin, ranging from 30-950 tons per sq mi in glaciated terrain and from 37-500 in unglaciated areas, with the highest yields from farmland in the Piedmont. Coal mining contributes sediment, but apparently no more than other cleared-land activities. Available data suggest that forest cover and overland runoff are the 2 principal factors that determine stream sedimentation rates throughout most of the basin. Knowledge of these 2 variables permits prediction of the annual sediment yield of basins in unglaciated terrain with an average error of about 25%. The sediment consists of 15% sand, 55% silt, and 30% clay. Piedmont streams carry more silt and clay than other streams in the basin. Reservoir silting is slight, but small reservoirs and recreation pools in larger reservoirs have some problems. Reservoir sedimentation surveys suggest a long-term downward trend in sedimentation rates since the 1930's. (Knapp-USGS)
W69-01190

2K. Chemical Processes

THE ION-EXCHANGE REACTIONS OF RADIOACTIVE IONS WITH SOILS AND EFFECTS OF ORGANIC COMPOUNDS,

Illinois Univ., Urbana.

For primary bibliographic entry see Field 05B.

For abstract, see .

W69-00726

CHEMICAL CHARACTER OF GROUND AND SURFACE WATERS IN RELATION TO SOIL WEATHERING PROCESSES,

New Hampshire University, Durham.

A. B. Prince, and H. Chien.

Project Completion Report. Report, Water Resource Res Center, N.H. Univ., Durham, 7 p text, 31 tab, 8 append. June 1968, 46 p, OWRR Project A-002-NH.

Descriptors: *Soil water, *Water chemistry, *Weathering, Leaching, Iron, Movement, New Hampshire.

Study of the soil water chemistry of a wooded site on the bank of Oyster River, New Hampshire, showed that dissolved solids are removed from the area at a maximum rate of about 140 tons per year per sq mi with approximately 120 tons from rock

dissolution and 20 tons from rainfall and human sources. The relationship of silica to discharge suggests that 10-12 ppm silica may be a criterion for determining when all streams flow is from ground water. Where the soil was well-drained and aerated, the contribution of iron to the river water was small. Where the soil was very poorly drained and aerated, the concentration of iron in the soil water was high and probably was a major source of the iron in the river water. As flow from the wetland increases, iron and organic content increase but pH and alkalinity decrease. Studies of the movement of iron in well-drained Melrose soil showed that the amount of iron in solution was relatively low and diminished with depth, resulting in a net accumulation of iron at an average depth of 2 in.-8 in., and iron released to the soil solution at or near the soil surface did not penetrate the top 16 in. of soil over an 84-day period under conditions of relatively high precipitation (10.32 in.), warm temperature (70-80 F) and absence of large channels. (Knapp-USGS)
W69-00925

SOLUBILITY EQUILIBRIA INVOLVING METAL OXIDES AND CORRESPONDING AQUEOUS METAL PERCHLORATES,

North Carolina Univ., Chapel Hill, Chem Dept.

Forrest C. Hentz, Jr.

Water Resour Res Inst Rep 7, 1967. 16 p, 2 fig, 3 tab, 26 ref. OWRR Project A-005-NC.

Descriptors: Equilibrium, *Turbidity, *Titanium, Supersaturation, *Chemical precipitation, *Polymers.

Identifiers: *Hydrolytic polymers, Light-scattering method, Polymerization.

Light-scattering measurements at 25 deg C on Th (NO₃)₃ sub 4 solutions containing 0, 1, 2, and 3 bound hydroxyls per thorium atom hydroxyl number have been made over the range 0.01-0.10M in total Th with each solution also 1.0M in NaNO₃ sub 3. The weight-average degree of polymerization calculated for each stage of hydrolysis agrees essentially with that found previously for a perchlorate medium; however, estimated charges at the lower hydroxyl numbers are substantially less, indicating complexing of the thorium species by nitrate. Results indicate equilibrium solutions and degrees of polymerization near unity at hydroxyl numbers 0 and 1, and degrees of polymerization of 3-4 at hydroxyl number 2. At hydroxyl number 3, a degree of polymerization near 120 was found for clear solutions aged approximately 1 month; after an additional 2-month aging period, an increase of some 25% in molecular weight was observed, with solutions of Th concentration above 0.07M showing faint visible turbidity. Some preliminary kinetic measurements for thorium solutions hydrolyzed to hydroxyl number greater than 3 are reported.

W69-00998

THE SPECTROPHOTOMETRIC DETERMINATION OF NITRATE IN WATER USING 2-NITROSO-1-NAPHTHOL-4-SULFONIC ACID.

Southern Illinois Univ., Carbondale.

Frank N. Abercrombie, and Albert L. Caskey.

Proj Rep, June 1966. 15 p, 3 fig, 5 tab, 3 ref. OWRR Project A-014-III.

Descriptors: *Water analysis, *Chemical analysis, Water chemistry, Chemical reactions, *Nitrates, *Spectrophotometry, Spectroscopy, Analytical techniques, Absorption, Ultraviolet radiation.

Identifiers: Infrared spectroscopy.

2-Nitroso-1-naphthol-4-sulfonic acid reacts quantitatively in a few minutes with excess nitrate in a dilute, acidic, aqueous medium to form 2,4-dinitro-1-naphthol. The work reported here concerns the determination of conditions under which nitrate reacts quantitatively with an excess of standard 2-nitroso-1-naphthol-4-sulfonic acid. The establishment of such a set of conditions indicates the feasibility of developing a spectrophotometric method

for the determination of nitrate based on its reaction with 2-nitroso-1-naphthol-4-sulfonic acid. Reagent grade chemicals meeting American Chemical Society specifications were used whenever they were commercially available. All other chemicals were of the highest grade available. Equipment and procedures are described and results indicate that it is feasible to develop a method for the spectrophotometric determination of nitrate utilizing 2-nitroso-1-naphthol-4-sulfonic acid.
W69-01113

ROLE OF CERTAIN STREAM-SEDIMENT COMPONENTS IN RADIATION SORPTION,

U.S. Geological Survey.

E. A. Jenne, and J. S. Wahlberg.

U.S. Geol Surv Prop Pap 433-F, pp F1-F16, 1968. 16 p, 4 fig, 7 tab, 41 ref.

Descriptors: *Sorption, *Dialysis, *Radioisotopes, Clay minerals, Carbonates, Oxides, Cobalt radioisotopes, Cesium, Strontium radioisotopes.

Identifiers: Radioisotope sorption (Sedimentary), Ion manganese.

'Natural' and laboratory 'dialysis' mass-action selectivity coefficients were determined for the sediment fractions smaller than 0.25 mm and for the 2-0.25 mm sediment fractions to evaluate the comparability of these 2 types of selectivity coefficients and the effectiveness of nonclay components in controlling the distribution of radioisotopes between solid and liquid phases. Stream water and surficial bed sediment were sampled in Whiteoak Creek, Tenn., which carries low-level-radioactive waste waters from Oak Ridge National Laboratory. Appropriate mass-action selectivity coefficients were calculated. Sr-90 sorption was controlled by precipitated carbonates. The selectivity coefficient was 9.6 for the natural carbonates and 1.2 for laboratory dialysis. Co-60 sorption was controlled by Mn and Fe oxides and the natural selectivity coefficients were the higher. Cs-37 sorption was controlled by clay minerals, with higher natural selectivity coefficients. Natural and laboratory selectivity coefficients were not comparable in many instances. This is attributed to partial dissolution of finegrained carbonates and of manganese and iron oxides, and in part to the largely irreversible nature of cobalt-60 and cesium-137 sorption. The laboratory and the natural selectivity coefficients for cesium-137 agreed within a factor of 2. (Knapp-USGS)
W69-01176

2L. Estuaries

ESTUARIES - INVENTORY - STUDY, SENATE REPORT NO 1419.

For primary bibliographic entry see Field 06B.

For abstract, see .

W69-00781

MUNICIPAL LIQUIDATORS, INC V TENCH (AVULSION AND EROSION).

153 So 2d 728-731 (Fla DCA 1963).

Descriptors: *Florida, Avulsion, Erosion, Judicial decisions, Bank erosion, *Boundary disputes, Boundaries (Property), High water mark, *Ownership of beds, Beds, Beds under water, Water law, Riparian rights.

Identifiers: *Government lots, *Tampa Bay.

This was a suit in chancery for a declaratory decree. Defendant owned a government lot bordering on Tampa Bay. The government survey of 1884 showed that at that time defendant's government lot included land between plaintiff's property and the waters of Tampa Bay. This part of defendant's lot is now submerged, so that plaintiff's property extends to the water's edge. Plaintiff now seeks to purchase the submerged land in front of his property, including what was formerly part of defendant's government lot, for the purpose of filling. The

court found that the now submerged part of defendant's government lot had disappeared by erosion, hence title reverted to the state. The court rejected defendant's contention that the land was lost by avulsion, hence title remained in defendant. Where land becomes submerged, erosion is presumed, and the burden of proving avulsion is on the party alleging avulsion. The case discusses the distinction between avulsion and erosion. (Kirkconnell-Fla) W69-00834

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

WATER WELL YIELDS FROM CRYSTALLINE ROCKS OF NORTHERN NEW JERSEY,
Rutgers Univ., New Brunswick.
Bennett L. Smith, and Darryl A. James.
Dept Geol Pub 1968. 8 p, 4 tab, 6 ref. OWRR Project A-007-NJ.

Descriptors: Crystalline rocks, *Water wells, *Water yield, Gneisses, *Groundwater, *Permeability, Faults (Geology), Joints, Granites. Identifiers: Diorite.

For more than 10 yr, a study has been carried out of the crystalline Pre-cambrian rocks which form the bedrock throughout some 1200 square mi of Northern New Jersey. This has resulted in a new geologic map of the region. As a byproduct of this work, a study of water well yields has been made in relation to lithology and structure, in order to provide guidelines for well development. This report includes an analysis of well yield with respect to rock type. It also includes certain findings as regards relationship of well yield to geologic and topographic structure. Further details including findings relative to structure will be incorporated in a publication, now being prepared.

W69-00707

SUBSURFACE FLOW IN A SOUTHERN ILLINOIS FRAGIPAN SOIL,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-00717

WATER-RESOURCES APPRAISAL OF CLAYTON VALLEY-STONEWALL FLAT AREA, NEVADA AND CALIFORNIA,
U S Geological Survey, Washington, D C, Water Resources Division.

F. Eugene Rush.
Nev Dep of Conserv and Natur Resources, Water Resources-Reconnaissance Ser Rep 45, 54 p, May 1968. 3 fig, 1 plate, 16 tab, 34 ref.

Descriptors: *Water resources, *Groundwater, *Surface waters, Data collections, Hydrologic data, Water quality, Water yield, Nevada, California, Alluvium, Valleys. Identifiers: Clayton Valley-Stonewall Flat area, Nevada.

A reconnaissance water resources study was made of the Clayton Valley-Stonewall Flat area of Nevada and California. The area 80 miles north to south and 60 miles east to west, has population less than 1,000. The valleys are bounded by mountain ranges about 9,000 ft high. Most of the available groundwater is stored in valley-fill alluvium, which is 600 or more ft thick. The valley flats receive about 5 in. precipitation a yr; most recharge is stream water from the mountains, where precipitation is as high as 15 in. per yr. Perennial yield is estimated to be 22,000 acre-ft per yr in Clayton Valley and from 100-3,000 acre-ft per yr in the smaller valleys of the area. Present groundwater development in the area is only 2,090

acre-ft per yr. The water is of fair to poor quality for agricultural use and marginal in quality for drinking. Chloride, sulfate and TDS are excessive. Tabulated data include hydrologic, topographic, climatic, and drainage summaries, runoff, evapotranspiration, pumping, groundwater budgets, chemical analyses, perennial yield, transitional storage reserve, well data, spring data, and drillers' logs of wells. (Knapp-USGS)
W69-00935

MANAGEMENT OF HYDROLOGIC SYSTEMS FOR WATER QUALITY CONTROL,
California University, Berkeley, Water Resources Center.

Philip C. Woods.
Calif Univ Water Resources Center Contrib No 121, 121 p, June 1967. 39 fig, 4 tab, 56 ref, 1 append. OWRR Project A-004-Cal.

Descriptors: *Water quality control, *Management, *Simulation analysis, *Model studies, Mathematical models, Linear programming, Systems analysis, Irrigation practices, California, Flow augmentation.

Identifiers: *Hydrologic systems, Sacramento River, Hydrologic models.

Management of hydrologic systems entails not only the design and construction of physical works for supplying water and removing waste water but considers the impact of these operations on water quality throughout the system. As an example of hydrologic system behavior, irrigation systems, which may be represented as controlled hydrologic entities, were examined. A systematized approach for predicting the quality response of these systems to changes in irrigation practice was proposed, and a series of mathematical models through which river system operation could be simulated on a digital computer was suggested. These models were described, and results obtained by simulation of the Sacramento River System were compared to the quality response of the prototype. Among the parameters which could be manipulated for system management, flow augmentation and ground water elevation control were shown to be significantly effective. The most dramatic changes in system response, however, resulted from changes in irrigation operations. Simulation approaches lead to the ultimate management goal of optimization techniques. (Knapp-USGS)
W69-00938

THE AVAILABILITY OF SUB-SURFACE WATER IN MISSOURI FOR CONSUMPTIVE USE BY PLANTS,

Missouri Univ., Columbia, Soils Dept.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-00999

WATER CONSUMPTION BY PHREATOPHYTEs,

Arizona Univ., Tucson. Dept. of Watershed Management.

Paul G. Sebenik, and John L. Thamas.
Prog Agri, Vol 14, No 2, pp 10-11, March-April 1967. 2 p, 1 tab.

Descriptors: *Phreatophytes, *Arid climates, *Consumptive use, *Transpiration, Evapotranspiration, *Tamarisk, Water loss, Evaporation pans, Measurement, Brush control, Arizona.
Identifiers: Tents.

Phreatophytes in the 17 western states occupy about 15 million acres of stream bank and river bottom sites and consume large quantities of water. Transpiration by tamarisk shrubs occupying a narrow flood plain near Winkelman, Arizona, was measured during the summer of 1966 by the tent technique. On all days of measurement, evapotranspiration from areas enclosed by the tent exceeded pan evaporation. An average monthly loss of 1.1 acre-feet of water per acre occurred

from July to September. Suggestions on how this water could be salvaged for more valuable use were given together with problems that arise when phreatophytes are removed from river channels. Since phreatophytes occur in large numbers along streams and rivers in arid areas, their contribution to water losses that occur in these areas must be studied and understood. (Blecker-Ariz)
W69-01012

ATTRACTION OF ATMOSPHERIC MOISTURE BY WOODY XEROPHYTES IN ARID CLIMATES,

Volcani Institute of Agricultural Research, Rehovot, Israel.

I. Gindell.
Commonwealth Forest Rev, Vol 45 (4), No 126, pp 297-321, December 1966. 25 p, 11 fig, 8 tab, 33 ref.

Descriptors: *Arid climates, Moisture tension, *Soil moisture, Soil-water-plant relationships, Precipitation (Atmospheric), *Xerophytes, *Tamarisk, *Meteoric water, Dry seasons, Wet seasons, Plant physiology, Humidity.
Identifiers: Ionic concentration, Moisture index.

The participation of atmospheric water in the arid climates with respect to the control of water shortage in woody xerophytes and in the reduction of moisture tension in the soil was followed in three ways: (a) By comparison of soil moisture in forest plantations with that of neighboring bare areas of identical make-up. (b) By comparing the fluctuations in soil moisture in the two areas during the dry and rainy seasons. (c) By investigation of the process of entry of water into the leaves, its passage into the stem and roots and the egress of the excess into the soil surrounding the roots. In the desert region, there was no reduction in the foliage of various species of tamarisk during the driest and hottest months of the year. In the desert, in deep sands, absorption from great depth (270cm) was possible owing to the gradual decrease in moisture with depth. (Blecker-Ariz)
W69-01014

PREPARED WATER CATCHMENTS,

G. H. Young.
J Agr S Australia, Vol 69, No 2, pp 73-77, September 1965. 5 p, 1 tab, 7 photo.

Descriptors: *Arid climates, *Watersheds (Basins), *Runoff, *Water conservation, *Costs, Grading, Erosion control, Contour furrows, Dams, Weed control, Roads, Channels.

Two methods are described which have been used to increase runoff and improve catchments of farm dams in the Eyre Peninsula of South Australia. The road-type catchment is a series of roads side-by-side across the slope of the land. It is found to be extremely effective in flat areas where runoff does not occur except after heavy storms. Cost for each stage of the catchment construction is given. The contoured catchment is used in hilly country with slopes ranging from 5-15%. Cost of constructing a contour catchment is similar to the road-type catchment. These methods are but two more ways in which water harvesting can be done in arid climates. (Blecker-Ariz)
W69-01016

ECONOMICS OF WATER CONSERVATION WITH MONOMOLECULAR FILMS: PART I,
Waterloo, Univ., Ontario, Canada.

P. L. Silveston.
Amer. Soc. of Agr. Eng. Trans. Vol 8, No 1, pp 127-134, 137, 1965. 9 p, 14 fig, 3 tab, 27 ref.

Descriptors: Economic efficiency, *Water conservation, Alcohols, *Monomolecular films, *Evaporation control, Cost-benefit analysis, *Farm ponds, Climatic data, Application methods, Instrumentation, On-site tests, Ponds, Films, Retardants, Winds.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3B—Water Yield Improvement

Identifiers: Dusting.

This paper examines the cost of increasing the capacity of farm ponds by suppression of evaporation through use of monomolecular films of long-chain fatty alcohols. Cetyl alcohol and stearyl alcohol were found to be among the most effective compounds for reducing evaporation and were the most promising in regard to cost and availability. In order to estimate cost of water saved by evaporation suppression, both amount of evaporation and percent reduction obtained for given treating conditions must be known. Summaries of many field test observations were presented in a table together with a summary of cost assumptions and a comparison of treating method costs for a one-acre pond. Two hypothetical cases illustrated how data and procedures given in the paper could be applied. (Blecker-Ariz)
W69-01017

AN APPLICATION OF PRINCIPAL COMPONENT ANALYSIS AND FACTOR ANALYSIS IN THE STUDY OF WATER YIELD.

Tennessee Univ., Knoxville, Tennessee.

For primary bibliographic entry see Field 02E.

For abstract, see .

W69-01064

WATER RESOURCES OF DELAWARE COUNTY, INDIANA,
U S Geological Survey, and Indiana Department of National Resources.

R. E. Hoggatt, J. D. Hunn, and W. J. Steen.
Indiana Div of Water Bull No 37, 57 p, 1968. 23 fig, 1 plate, 8 tab, 27 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, Water quality, Aquifers, Data collections, Indiana, Water yield, Streamflow.
Identifiers: Delaware County (Indiana), Muncie (Indiana).

Delaware County, Indiana has ground and surface water resources of sufficient quantity and quality to meet present needs and predicted increased requirements for agricultural, domestic, and municipal use. Present use, 80% of which is Muncie municipal water, totals about 18.5 mgd of which 63% is from surface sources. Muncie's water supply is obtained from the White River, which flows more than 20 cfs or 13 mgd 90% of the time from a drainage area of 242 sq mi. Low flow is augmented by releases from Prairie Creek Reservoir. The Mississinewa River drains 304 sq mi and yields over 8 cfs 90% of the time; its development potential is good. Streams in the northern part of the county frequently go dry, but in the southern half, most yield over 0.013 mgd per sq mi 90% of the time. Buck Creek yields over 6.5 mgd 90% of the time. Aquifers within 400 ft of the surface yield nearly all the groundwater. Well can yield as much as 1,000 gpm in the south central and southwest. The principal aquifers are silurian dolomite, which yields up to 500 gpm, and Pleistocene sand and gravel, some of which fills buried valleys. The waters of the county are moderately hard. Some groundwater may have excessive iron. (Knapp-USGS)
W69-01177

STUDIES OF CONSUMPTIVE USE OF WATER BY PHREATOPHYTE AND HYDROPHYTE NEAR YUMA, ARIZONA,
U S Geological Survey.

For primary bibliographic entry see Field 02I.

For abstract, see .

W69-01178

WATER RESOURCES OF THE LETTSWORTH-INNIS-BATCHELOR AREA, POINTE COUPEE PARISH, LOUISIANA,
U. S. Geological Survey.
A. H. Harder, V. B. Sauer, and W. L. Brouard.
Louisiana Dep of Conserv Geol Surv and Dep of Public Works Water Resources Pam No 21, Jan 1968. 1 plate, 6 tab, 6 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, Data collections, Water quality, Water yield, Louisiana, Mississippi River Basin.
Identifiers: Pointe Coupee Parish (Louisiana).

Large quantities of surface and groundwater of good quality are available in Pointe Coupee Parish, Louisiana. The nearby Mississippi River has an average flow of about 600,000 cfs and a minimum flow of about 75,000 cfs. Dissolved-solids concentrations in the river range from about 110 to 400 ppm, hardness from 70 to 200 ppm, sediment from 50 to 3,500 ppm, and pH from 6.7 to 8.2. Raccourci Old River, which is connected to the Mississippi River, contains about 15 to 30 billion gal of water, depending on its stage and that of the Mississippi River. The quality of its water is similar to that of the Mississippi River. Large quantities of fresh groundwater are available from underlying sands in thickness from 20 to more than 100 ft. Large-diameter wells may yield as much as 1,500 gpm each, with specific capacities up to 75 gpm per ft of drawdown. Groundwater levels range from a few ft below land surface in wells screened at depths of 50-400 ft deep to as much as 15 ft above land surface in wells screened from 1,000 - 1,200 ft deep. The quality of groundwater improves with depth. Wells less than 400 ft deep usually yield a calcium bicarbonate type water that is hard and high in iron. Deeper wells (400 to 1,200 ft) usually yield a softer, sodium bicarbonate water having a hardness of 4 to 80 ppm, less iron (0.00 to 1.4 ppm), and a pH of 7.0 to 8.8. (Knapp-USGS)
W69-01183

3C. Use of Water of Impaired Quality

ENGINEERING ASPECTS OF THE RECLAMATION OF SODIC SOILS WITH HIGH-SALT WATERS,

Dept. of Agriculture, Mandan, No. Dakota, Agricultural Research Service.
Eugene J. Doering, and Ronald C. Reeve.
J Irrigation and Drainage Div, ASCE, Vol 91, No 1R 4, Proc Paper 4588, pp 59-72, Dec 1965. 14 p, 6 fig, 2 tab.

Descriptors: *Saline water, *Alkaline soils, Fine-textured soils, *Land reclamation, Hydraulic properties, Hydraulic conductivity, *Leaching, Electrolytes, *Sodium, Soil chemistry, Soil profiles, Infiltration, Ions, Cation exchange, Percolation, Permeability, Equations, Gypsum.
Identifiers: *Engineering aspects.

A laboratory study was conducted to show that sodic fine-textured soils were impossible to reclaim by applying gypsum to the surface and that the high-salt-water dilution method was effective within limits. A combination of the two methods appeared to be both effective and practical. Basic principles and calculation procedures involved in the engineering evaluation of a reclamation program were presented. Hydraulic properties of sodic soils were functions of both electrolyte concentration of the leaching solution and exchangeable-sodium status of the soils. They were also dependent on the previous history of the sample. Therefore, estimates of time needed for reclamation must still be based on empirical determinations of the infiltration rate for the soil in question. (Affleck-Ariz)
W69-01023

USING SALT TO INCREASE IRRIGATION WATER,

Arizona Univ, Tucson, College of Agriculture.
Brent C. Cluff, and Gordon R. Dutt.
Reprint, Prog Agr Ariz, Vol 18, No 3, pp 12-13, May-June 1966. 3 p, 4 fig. OWRR Project A-001-ARIZ.

Descriptors: Watershed management, *Water yield, Water storage, Water utilization, Sodium chloride, Soil sealants, *Runoff, Irrigation water.

Sodium chloride was added to soil material in pans and on a field plot. It was found that the 'Mo' effectively dispersed and sealed the surface, thus increasing runoff. During the last half of the winter rainfall period, runoff was 25 times greater on the treated plot than on the check plot. Of the 2.90 in. of precipitation, 10.3% was measured as runoff from the treated plot. The runoff from the salted plot contained less than 200 ppm dissolved salts. It was estimated that the treatment cost could be below \$12.00 per acre.
W69-01160

3D. Conservation in Domestic and Municipal Use

URBAN WATER USE STUDY,

Colorado Univ., Boulder and Mexico Secretaria De Recursos Hydraulicos.

J. Ernest Flack, and Fortunato Martinez.
Amer Soc Civ Eng, Conf Preprint 350, May 1966. 38 p, 4 fig, 14 tab, 5 ref. OWRR Project A-005-Colo.

Descriptors: *Urban areas, *Water utilization, Water costs, Colorado, *Municipal water, Cities, Municipalities, Elasticity, Return flow, Consumptive use (Water), *Industrial water.

A study was made of domestic and industrial water consumption in the cities of Boulder, Denver, and Colorado Springs, Colorado and Monterrey, Nuevo, Mexico. Available data limited study to the period 1957-1964. Results show trends of interest which should be of value in future water supply studies.
W69-00721

3F. Conservation in Agriculture

RECESSION CHARACTERISTICS OF IOWA STREAMS: PART 1 - TEMPORAL AND AREAL DISTRIBUTION OF RECESSION CONSTANTS,

Iowa State Univ., Ames.

For primary bibliographic entry see Field 02E.
For abstract, see .

W69-00718

MANAGEMENT OF HYDROLOGIC SYSTEMS FOR WATER QUALITY CONTROL,

California Univ., Berkeley.

For primary bibliographic entry see Field 06A.
For abstract, see .

W69-00724

FEDERAL PROJECTS FOR IRRIGATION AND WATER SUPPLIES.

43 USCA Secs 390-390f (1964).

Descriptors: *Legislation, *Federal project policy, *Cost allocation, Irrigation programs, Federal Reclamation Law, Cost repayments, Federal government, State governments, Local governments, Water resources development, Leases, Dams, Reservoirs, Reservoir storage, Water storage, Water rights, Water policy, Cost-benefit theory, Projects, Water supply.
Identifiers: *Secretary of the Interior, Secretary of the Army, Corps of Engineers, Bureau of Reclamation.

Whenever the Secretary of the Army determines that any dam or reservoir project under his direction may be used for irrigation purposes, the Secretary of the Interior is authorized to construct and maintain such additional works in connection therewith as he may deem necessary for irrigation purposes. These works may be undertaken only after specific authorization by Congress. Section 390b declares that it is the policy of Congress to recognize the primary responsibilities of state and local interests in developing water supplies and that

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the Federal Government should cooperate with the states and local interests. Section 390b also contains several provisions for the determination and allocation of costs on such projects. The other sections deal chiefly with the acquisition of rights in such projects by state and local interests, their obligations for operation, maintenance, and costs, and with contracts and lease revisions concerning these rights and obligations. The source includes historical notes and notes of decisions, and is kept up to date with annual supplements. (Smidish-Fla) W69-00757

HOOVER V CRANE (REASONABLE USE RULE APPLIED TO IRRIGATION).

362 Mich 36, 106 NW 2d 563-566 (1960).

Descriptors: *Michigan, Civil law, Judicial decisions, Irrigation, Irrigation effects, Effects, Evaporation, *Reasonable use, Artificial use, *Competing uses, *Riparian rights.

Plaintiff owned a lake-front cottage. Defendant's farm also fronted on the lake, occupying about ten percent of the lake frontage. In the summertime the water level of the lake often fell so low that the flow at the lake's single outlet ceased. During one such dry period, defendant began pumping water from the lake for irrigation purposes. Plaintiff sued, claiming that the drop in the lake level that summer was due to defendant's irrigation activities. Defendant contended it was due to natural causes, and that the irrigation was of great benefit to him and contributed only slightly to plaintiff's discomfiture. The court, employing the reasonable use rule, held that an injury that is incidental to a reasonable enjoyment of a common right can demand no redress. The reasonableness of the use is determined by its extent, duration, necessity, and application; the nature and size of the stream, and the several uses to which it is put; the relative injuries and benefits to the various riparian owners; and all other material facts. The court held the defendant's use to be reasonable, but affirmed an order of the lower court restricting the defendant to removing no more than one quarter-inch from the lake during those periods when the level of the lake fell below the level where it flowed from the lake's outlet. (S. Scott-Fla) W69-00889

MAXIMUM AND OPTIMUM NORMS OF BOG DRAINAGE (RUSSIAN),

A. I. Ivitskii.

Transl by Israel Program for Scientific Transl (IPST) 1968, Cat. No. 1988. Available from CFSTI as TT 67-51317. Trans from Gidrotekhnika: Melioratsiya, No 12, pp 33-42, 1962. 11 p, 2 fig, 4 tab, 16 ref.

Descriptors: *Drainage effects, *Marsh management, *Soil physical properties, *Soil chemical properties, Soil water, Soil-water-plant relationships, Dewatering, Drainage wells, Furrow drainage. Identifiers: USSR, Bog drainage.

An investigation of the relation between depth of bog drainage and agricultural productivity shows that in many cases productivity is higher with drainage to depths of 350-450 cm than with the more commonly used drainage depths of 130-150 cm. Further depression of water levels to 220-260 cm yielded no further improvement and in some cases caused lower yields. For intertilled crops, including spring wheat, sugarbeet, potatoes, and cabbage, average water depth should be at least 60 cm in April and 100 cm the rest of the growing season. For hemp, depth should be at least 62 cm in April and 112 cm the rest of the growing season. The optimum air regime of the soil occurs with a water depth of 120-130 cm, and the maximum tolerable carbon dioxide level occurs with a water depth of 100 cm. (Knapp-USGS) W69-00913

SOIL MOISTURE AND SOIL TEMPERATURE CHANGES WITH THE USE OF BLACK VAPOR-BARRIER MULCH AND THEIR INFLUENCE ON PINEAPPLE,
Hawaii Univ., Manoa.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-00984

SUB-SURFACE IRRIGATION OF TURF AREAS, NOZZLE DESIGN AND SPACING,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-00996

AN ECONOMIC ANALYSIS OF WISCONSIN'S DIVERSION PERMIT SYSTEM FOR AGRICULTURAL IRRIGATION,
Wisconsin Univ., Madison, Agri Econ Dept.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-01000

DEVELOPMENT OF METHODS FOR INCREASING THE EFFICIENCY OF WATER USE IN CRANBERRIES,
Massachusetts Univ., Amherst, Cranberry Exp Sta.
John S. Norton.
Pap, Symp Water Resour Res, June 1967. 16 p, 15 fig, 1 tab. OWR Project A-005-Mass.

Descriptors: *Cranberries, *Dikes, Irrigation systems, Irrigation efficiency, *Flood irrigation, *Water harvesting, Bogs, Equipment.

Materials were procured for an assortment of temporary dikes for cranberry bogs and 7 dikes were built. Two dikes were vinyl sheeting supported on railings and anchored below ground by 1 by 2 in. wood strips. One dike was aluminum, supported by a wood railing. Three dikes were earth with sheet aluminum cores. Two of the earthen dikes were built over filled-in ditches, the third built on bog surface. The seventh dike was erected on private property but removed prior to testing. Only the sheet vinyl and aluminum dikes were constructed in time for testing in 1966. Considerable difficulty was experienced because of washouts under both the vinyl and aluminum sheeting. Tests will be made on all dikes in 1967 in conjunction with work under Hatch Project No 51. The current trend toward water harvest methods. The equipment consists of an elevator to remove the berries from the water surface, and a blower, ducting, and screen to separate debris from the berries before they are loaded into trucks.
W69-01001

SEALING PONDS CHEMICALLY,
Tennessee Univ., Knoxville.
John I. Sewell.
Agricultural Engineering, Vol 48, No 5, pp 270-71, May 1967. 2 p, 1 fig, 2 photo.

Descriptors: *Ponds, Permeability, *Chemicals, *Sealants, Evaporation control, Ion exchange, Dispersion, *Soil sealants, Farm ponds.

Effectiveness of chemical treatment in sealing ponds against water loss was evaluated on the basis of resulting reduction in permeability of the soil sample. In many cases permeameter discharge rates were taken for 30 or more days before discharges approached steady-state condition. In tests where treatments were ineffective, permeability rates (K) always tended to increase with time. Results of sodium chloride treatments indicated that K decreased for about one week, then rapidly increased. This may be because the reaction between sodium and calcium ions in the soil produces calcium chloride, which is highly soluble in water. As the calcium chloride dissolved, a reversal of this reaction took place. Principles, objectives and procedures of sealing ponds chemically were outlined. (Blecker-Ariz)
W69-01019

EFFECT OF IRRIGATION METHOD ON WATER CONSERVATION,
Utah State Univ., Logan.
Jack Keller.

J of Irrigation and Drainage Div, ASCE, Vol 91, No 1R2, Proc Paper 4364, pp 61-72, June 1965. 12 p, 1 fig, 7 tab.

Descriptors: *Irrigation effects, *Water conservation, *Irrigation efficiency, Sprinkler irrigation, Cost analysis, Arid lands, *Economic efficiency, Surface irrigation, Comparative costs, On-site investigations, *Farm management.

Water use efficiency and economic factors as a basis for the selection of irrigation methods for farm systems and projects were examined. A brief review of comparative studies of water application and operational efficiencies was presented. A review of comparative irrigation costs demonstrated the relative cost between methods and facilities when the limiting resource was land or water. The effect of methods on the management of both farms and projects was also considered. A major problem in soil and water conservation in arid regions throughout the world is how adequate but not excessive depths of irrigation water can be economically applied to soils. (Affleck-Ariz)
W69-01021

WATER POLLUTION CONTROL IN SEMI-ARID AND ARID ZONES,
Hebrew Univ., Jerusalem, Israel.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-01024

BASIN FORMING AND RESEEDING OF RANGELAND,
Dept. of Agriculture, Tucson, Soil Conservation Service.
K. R. Frost, and Louis Hamilton.
Trans. Amer Soc Agr Eng, Vol 8, No 2, pp 202-203, 207, 1965. 3 p.

Descriptors: *Basins, Planting management, Vegetation regrowth, Semiarid climates, Range grasses, *Revegetation, *Mechanical equipment, Arid lands, *Desert plants, *Soil moisture, Ranges, Soil-water-plant relationships, Seeds, Wet seasons, Dry seasons.
Identifiers: Semidesert, *Reseeding, *Basin forming.

Improvement of semidesert ranges through reseeding is usually unsuccessful because of poor soil moisture conditions. Three mechanical systems for improving success of semidesert ranges were developed and evaluated. The systems were: forming and seeding fan-shaped basins, basin-forming on knifed rangeland and seeding in pits formed by a pitting disk. Sloping fan-shaped basins were a practical device for collecting rainfall for range grass seeding if the soils were suitable. Such basins were formed at a low cost with a tractor and blade designed for this purpose. Moisture penetration of 30 inches in medium soils was possible with four or five high-intensity storms of less than one-half inch each and totaling two inches. Appropriate basins were pressed into loose knifed rangeland by a blaster roller. (Blecker-Ariz)
W69-01028

HUMAN RESOURCES AND REGIONAL DEVELOPMENT: SOME LESSONS FROM FRENCH EXPERIENCE,
Kentucky Univ., Lexington.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-01099

ASPECTS OF SURFACE WATER RESOURCES - HUMBOLDT RIVER BASIN, NEVADA.
Nevada Univ, Reno.
D. F. Schulke, G. B. Maxey, and P. A. Domenico.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

Water Resour Res Center, Desert Res Inst, Proj Rep 6, Aug 1967. 57 p, 14 fig, 1 tab, 14 ref. OWRR Project A-011-Nev.

Descriptors: *Reservoir storage, *Irrigation water, *Water demand, *Water management (Applied), *Administration, *Surface water, Water permits, Irrigation efficiency, Flood irrigation, Appropriation, Water resources, Nevada, Conjunctive use.

Most streamflow for Humboldt River originates in the Upper Valley Unit, or headwaters in Ruby Range in extreme north eastern part of Nev., and the lower country, north and east sides of the basin with varying water rights for quantity/acre, length and type application. The river is essentially uncontrolled throughout its course except for one major control structure at Rye Patch just above terminal Humboldt Sink. However, there are at least 16 possible reservoir sites in addition to three reservoirs authorized for construction in the Upper Valley Unit, which could be operated beneficially for irrigation purposes and still operate within flood control capacity as shown by operational studies. Another proposal for supplementation of surface water is that of pumping ground water during periods of deficient streamflow. This would tap highly permeable gravel, which in turn would be rapidly replenished during frequent periods of natural flooding. Preliminary results of studies indicate there is a very good possibility of success for conjunctive use of ground and surface waters. Some type of management body, to be decided after review of possibilities and effectiveness of each body in handling basin problems, will be required if either upstream storage or conjunctive use is implemented in the basin to better utilize water resources. (J. Phoenix-Nevada). W69-01111

INVENTORY OF IRRIGATION AREAS AND DETERMINATION OF CONSUMPTIVE USE BY AREAS.

New Mexico State Univ, University Park.
Donald C. Henderson.
Agri Exper Sta, N Mex State Univ Final Rep, Jan 1967. 3 p. OWRR Project A-007-NMex.

Descriptors: Irrigation, *Consumptive use (Water), Water requirements, *Maps, *Irrigated land, Water rights, River basins, Water supplies, *Water sources, *Sites, Ground water, Surface water, *New Mexico.

A-map was constructed showing location of irrigated lands and source of water and areas of similar consumptive use factors in New Mexico. These maps have been published as research reports by the Agricultural Experiment Station, New Mexico State University.
W69-01131

A BIBLIOGRAPHY PERTAINING TO THE PECOS RIVER BASIN IN NEW MEXICO.

New Mexico State Univ, University Park.
John W. Hernandez, and Thomas J. Eaton, Jr.
Water Resour Res Inst Publ 2, 1967. 50 p, 398 ref. OWRR Project B-003-NMex.

Descriptors: *Bibliographies, *New Mexico, Reconnaissance surveys, Irrigation effects, Semiarid land, Water resources, Water resources development.
Identifiers: Pecos River (N Mex).

This publication is a direct result of a research proposal entitled 'Reconnaissance Study of the Pecos River Basin, New Mexico,' which was the ground work done in preparation for the interdisciplinary, inter-university research proposal entitled 'A Comprehensive Water Resources Analysis of a Typical Overdrawn Basin in an Irrigated Semiarid Area.'
W69-01133

TIME-INTEGRATED THERMAL EFFECTS OF FOREST IRRIGATION.

Pennsylvania State Univ, University Park.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-01141

AGRICULTURAL RESOURCES RELATED TO WATER DEVELOPMENT IN TEXAS,

Texas Agricultural and Mechanical Univ, College Station.

J. R. Runkles, and E. T. Smerdon.
Water Resour Inst, Agri Exper Sta, Texas A and M Univ, Sept 1965. 171 p, 16 fig, 35 tab, 59 ref. OWRR Project A-001-TEX.

Descriptors: Agriculture, *Texas, *Water resources development, Crop production, Cultivated lands, Irrigable land, Irrigated land, Natural resources, Resource allocation, Long-term planning, Planning, Bibliographies.

Texas is now developing a state water plan which will be a basic guide for water resources development in Texas through the year 2020. A special task committee at Texas A and M University assisted the Texas Water Development Board in the evaluation of future agricultural water requirements and its relation to water availability. To develop projections of requirements which would be useful in planning water resource development, the analysis was initiated with four models of agricultural resource requirements and production. Each model includes: (1) restrictions on production, (2) assumptions relative to resource availability and use, and (3) estimates of output with the specified use of resources. This report includes discussion and data concerning Texas' resources and environment, and results of the first two models. The first model gives maximum physical capacity of agriculture in Texas with no economic, institutional, or water restrictions placed on production or marketing of products. The second model gives projected resource use and product output with water available to all irrigable acres, but limited by costs.
W69-01143

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on THE Surface

EVALUATION OF DRAINAGE PROBLEMS IN WATERLOGGED AREAS AND BOLSONS IN NEVADA,

Nevada Univ., Reno.

A. I. Kashef.
Water Resour Res Center, Proj Rep 1, Sept 1965. 12 p, 1 map, 5 ref. OWRR Project A-002-Nev.

Descriptors: Drainage practices, *Drainage water, Drainage districts, Drainage systems, *Drainage programs, Irrigation practices, Water reuse, Saturated soils, *Planning, Artificial recharge, Waste water.

Although existing local drainage systems in Nevada adequately drain presently irrigated lands (drainage of existing areas of high water use is only barely adequate), the prospect of large increases of available water, primarily as a result of surface-water importation, necessitates an evaluation of the need for and the manner of implementation of a general state drainage plan. Considered in this report are preliminary studies of primary importance to such an evaluation: (1) completion of a state soils map, (2) completion of a drainage map, (3) grouping of basins into regional drainage units, (4) evaluation of the water balance in selected basins in order to estimate the amount of water that can be naturally discharged, (5) reevaluation of current

irrigation and drainage methods, (6) the possibility of establishing legal controls over the discharge of industrial wastes, and (7) a stepped-up program to determine the feasibility of recycling waste waters by means of ground water recharge. It is not the intention, however, of this report to present engineering solutions for current and anticipated drainage problems, but mainly to point out some of the more important aspects that need special attention.
W69-00738

H A BOSWORTH AND SON INC V TAMIOLA (DRAINAGE).

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-00747

CULBERTSON V GROSS (SURFACE RUNOFF).

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-00750

BOETTCHER V STROCK (ALTERATION OF FLOW).

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-00751

TREADWELL V WALDEIER (COMMON LAW RULE OF SURFACE DRAINAGE).

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-00752

TENNESSEE VALLEY AUTHORITY.

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-00758

TENNESSEE VALLEY AUTHORITY.

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-00759

REAL PROPERTY - WATER RIGHTS - LIABILITY FOR DISCHARGE OF SURFACE WATER,

Robert E. Hammell.
Mich L Rev, Vol 54, No 4, pp 574-577, Feb 1956. 4 p, 11 ref.

Descriptors: Surface drainage, *Surface runoff, *New Jersey, Civil law, *Judicial decisions, Reasonable use, *Repulsion (Legal aspects), Water law, Legal aspects.

This is a case comment on *Yonadi v Homestead County Homes, Inc*, 35 N J Super 514, 114 A 2d 564 (1955). The corporate defendants purchased a forty-acre tract above the plaintiffs' golf course. Drainage had always flowed from the higher tract through the golf course. Defendant constructed a subdivision, increasing the runoff onto plaintiffs' land by 350 per cent, and producing floods in heavy rains. Plaintiffs were awarded an injunction and damages at the trial level, and this was reversed. The civil law rule, common enemy rule and the reasonable use rule are discussed. New Jersey is a 'common enemy' state. It is pointed out that no matter which rule a state uses, it usually arrives at the reasonable use result through various exceptions, limitations, etc. It is concluded that most courts, although they will not come out and say it, are moving toward the more flexible reasonable use approach to surface waters. (R. F. Williams-Fla)
W69-00764

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Control of Water on the Surface—Group 4A

PIKE COUNTY BD OF EDUC V BELFRY COAL CORP (INJUNCTION AGAINST DRAINAGE FLOODING).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00788

AN ACT AUTHORIZING THE STATE OF INDIANA TO COOPERATE WITH THE UNITED STATES IN THE CONSTRUCTION, OPERATION AND MAINTENANCE OF MULTIPLE-PURPOSE RESERVOIRS.

Indiana Acts 1967, Ch 100. 2 p.

Descriptors: *Indiana, *Federal government, *Multiple-purpose projects, Flood control, Water supply, Water quality control, Recreation, State governments, Legislation, *Administrative agencies, Costs.

Identifiers: *State-federal cooperation.

Section 1 recognized that unregulated flow of rivers and streams has detrimental effects upon the state and that Indiana should cooperate with the United States or any other agency to improve flow regulation. Section 2 declares that storage reservoirs providing for flood control, water supply, water quality control, navigation and recreation are in the public interest of Indiana. Section 3 directs the Department of Natural Resources to cooperate with the United States in the planning, construction, operation and maintenance of various multiple-purpose projects and to share in the costs thereof. Such funds are to be included in the Department's Biennial budget request. (R. F. Williams-Fla)

W69-00790

PETTENGILL V TURO (OBSTRUCTION OF WATERCOURSE).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00797

VAN SZYMAN V TOWN OF AUBURN (DRAINAGE - EASEMENTS).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00809

CHESARONE V PINWOOD BUILDERS INC (DRAINAGE SYSTEM).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00811

CITY OF ATLANTA V WILLIAMS (SURFACE DRAINAGE).

For primary bibliographic entry see Field 06G.

For abstract, see .

W69-00825

TIEDEMAN V VILLAGE OF MIDDLETON (CITY'S DISCHARGE OF SURFACE WATER IN ACCORDANCE WITH NATURAL FLOW).

25 Wis 2d 443, 130 N W 2d 783-790 (1964).

Descriptors: *Wisconsin, Judicial decisions, *Cities, *Surface runoff, Surface drainage, Culverts, Embankments, *Natural flow.

Identifiers: Injunctions.

Appellants brought suit against defendant city to enjoin it from using a new drainage system which discharged water through a culvert under a railroad embankment into a pond on appellants' lands. Prior to the installation of the culvert, the natural drainage was such that, in the absence of the railroad embankment, it would have found its way into appellants' pond. The trial court denied relief, and the Supreme Court of Wisconsin affirmed. With regard to surface waters, cities have the same rights

as individuals. As long as the city does not tap a new watershed or increase the volume, it may channel surface water in its natural direction. A city may even change the natural flow by the construction of streets and gutters as long as it does not collect water in a body and then cast it on private land. Appellants had not obtained prescriptive right to have the embankment shield them from surface drainage since the element of reliance was lacking. Injunctive relief was not warranted because appellants suffered no irreparable injury. (R. F. Williams-Fla)

W69-00826

BEHM V KING LOUIES BOWL, INC (DRAINAGE OF SURFACE WATER).

350 S W 2d 285-291 (Mo 1961).

Descriptors: *Surface waters, *Drainage, *Drainage water, *Repulsion (Legal aspects), Water law, Legal aspects, Surface runoff, Riddance (Legal aspects), Floods, Rain water.

The main question in the tort action was whether the defendant was liable for damages caused by the manner in which surface water drained off its property. The court noted it is settled law that surface water is a common enemy which every man may ward off his land and throw on a lower owner, providing he does not collect it and discharge it to another owners damage. The defendant should have anticipated that the placement of railroad ties along the edge of his property would prevent water from being drained from the lot along the lines of natural flowage but would be diverted and caused to flow in a different channel in a damaging flood onto the plaintiff's lower property. The court held that the jury could have found the defendant guilty of actionable negligence and liable to the plaintiff for damage to his property for having caused it to be flooded in the manner that it was. (Horner-Fla)

W69-00827

CHAPPELL V WINSLOW (DIVERSION OF SURFACE WATER).

258 N C 617, 129 S E 2d 101-107 (1963).

Descriptors: *Drains, *Drainage systems, *Runoff, Drainage, Natural flow, Drainage effects, Floods, Surface water, Groundwater, *North Carolina.

The plaintiff sought to enjoin the defendants from altering the natural flow of water. The plaintiff claimed that if the defendant opened certain drainage ditches into the ditch running in front of his property, flooding could result and his land would be injured. The court affirmed the trial judge's finding that the plaintiff could be injured. In an action to enjoin one from collecting and discharging surface waters in volume, it is not necessary to prove that actual injury has already occurred. The remedy is preventive and may be had upon proof that the act complained of, unless restrained, will result in damage. (Horner-Fla)

W69-00828

PENDLETON V STUTTGART AND KING'S BAYOU DRAINAGE AND IRRIGATION DIST (ATTEMPTED WITHDRAWAL FROM DRAINAGE DISTRICT).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00829

DAY V MUMMEY (STORM DRAINS).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00830

REUTNER V VOUGA (DRAINAGE).

367 S W 2d 34-43 (St Louis Ct App, 1963).

Descriptors: *Repulsion (Legal aspects), Drainage, Surface runoff, Drainage water, Easements, Sewers, Subsurface drainage, Legal aspects.

The plaintiff and the defendant owned adjoining tracts of land. The plaintiff granted an easement to the city to build a sewer across his property. The defendant in the process of subdividing his property, dug a ditch on the easement to carry water off his land. The plaintiff sued for trespass to his land. The court held that the defendant was not entitled to build a ditch on the easement given to the city and the plaintiff was awarded damages in an amount equal to the cost of refilling the ditch and restoring the land. The court further noted that the defendant should be enjoined from discharging water collected through his sewer system upon the plaintiffs land. Under the common-enemy rule, one landowner may fend off surface waters without regard to his neighbor but he may not artificially collect and impound surface water and cast it in concentrated quantities onto the servient estate. (Horner-Fla)

W69-00832

FURTEK V WEST DEER TOWNSHIP (CLOSING DRAIN RESULTING IN INCREASED SURFACE WATER FLOW).

191 Pa Super 405, 156 A 2d 581-587 (1959).

Descriptors: *Surface water, *Drains, Watershed, Water flow, Gully, Conduits, Surface runoff, Time of concentration, Running water, *Surface drainage, Drainage, Culverts, Easements, Drainage effects, Drainage patterns, Drainage water, Subsurface drains, *Pennsylvania.

Action for continuing trespass against the township for the closing of a drain and the subsequent additional flow of surface water onto the plaintiff's property. Before the closing of the drain, three drains had carried water from the street down to the lake. The plaintiffs' property was at the lower end of the watershed. Before the drain was closed the plaintiffs had noticed some flooding of their property, but only at periods of hard rain. After the drain was closed a deep gully appeared along the line of the drain pipe that passed through the plaintiffs property making it unfit for any use. The plaintiffs had requested the township to take some action and commenced this suit only after the township refused to take any action. The township contended that they had the right to close and abandon any surface water drain without liability and that the plaintiffs' predecessor-in-title's consent release them from all liability. The court found that the closing of the drain caused more surface water to flow onto the plaintiff's property than had before and that the terms of the release should not be construed to cover matters which were not intended or contemplated, and therefore the township was liable. (Rief-Fla)

W69-00833

ARMSTRONG V WESTROADS DEVELOPMENT CO (SURFACE DRAINAGE).

380 S W 2d 529-538 (Ct App Mo 1964).

Descriptors: *Missouri, *Judicial decisions, *Surface runoff, Surface drainage, Streams, Riparian rights, Repulsion (Legal aspects), Natural flow, Culverts, Obstructions to flow.

Identifiers: *Non-riparian land.

Plaintiff Armstrong brought a suit for damages against Westroads Development Company and other defendants. Defendants, in connection with the construction of a shopping center, enclosed a natural stream in a concrete tube or culvert. The natural surface drainage from plaintiff's property had gone into this stream, and consequently such waters backed up on his property, causing damage thereto. Although plaintiff's property did not bound on the stream, he claimed that he had a right to have the stream continue its natural flow, and that anyone obstructing that flow was liable for damages caused thereby. The court held that the

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

right to the natural flow of a stream belonged only to a riparian owner thereon. Since plaintiff was a non-riparian owner he did not have a cause of action against defendant. The court pointed out that Missouri accepts a modified 'common enemy' rule as to diffused surface waters, and that if the landowner between plaintiff and the stream had so chosen he could have erected a barrier and completely repelled all drainage from plaintiff's land. (R. F. Williams-Fla) W69-00836

PETERS V SHULL (COLLECTION AND DISCHARGE OF SURFACE RUNOFF).

379 S W 2d 837-842 (Mo 1964).

Descriptors: *Judicial decisions, *Missouri, *Surface runoff, Drainage, Surface drainage, Reasonable use, Damages, *Alteration of flow, Water law, Legal aspects, Repulsion (Legal aspects). Identifiers: Damages (Legal aspects).

Plaintiff brought suit against defendant for allegedly changing the grading and raising part of its adjoining lot, thereby artificially impounding water in one body and discharging it on plaintiff's land, causing damage. Defendant had begun construction of a house, and had changed the natural lay of the land. The trial court found for the plaintiff. Defendant appealed and the Kansas City Court of Appeals affirmed. The court said that a dominant owner may not allow surface water to accumulate on his property and then discharge it at a single point, damaging to the property of the servient owner. The evidence properly showed such actions in this case. The measure of damages is the difference in market value of the land immediately before and after the injury, where, as here, the injury is permanent and substantial. (R. F. Williams-Fla) W69-00838

SPICER V WHITE BROS BUILDERS INC (DRAINAGE SYSTEMS).

193 N E 2d 274-279 (Ohio 1962).

Descriptors: Sewage, Septic tanks, *Sewage disposal, Titles, *Drainage systems, Channels, Sewage effluents, Damages, Earth dams, Surface water, *Ohio, Tile drainage, Ditches, Drainage water, Rivers, Watercourses (Legal).

This is an appeal by defendant from a judgment enjoining it from draining water or sewerage from Southwood subdivisions onto or across the lands of plaintiffs and ordering it to correct the drainage flow. The court here reversed stating that a preponderance of the evidence shows that the surface water draining into the ravine from the north end of Southwood consists with minor exceptions, of water which normally would have drained onto or across the lands of plaintiffs. Defendant corporation has merely collected this water and emptied it into the natural watercourse. The fact that such drainage, together with the other water draining therein, fills the old river bed is not due to any act of the defendant. The court also held that the defendant was not absolved by this action. The difficulty was that the plaintiffs failed to establish their claims by that degree of proof necessary to warrant this court to order the injunctive relief sought by plaintiffs. (R. Smith-Fla) W69-00840

MUNN V HORVITZ CO (PRESCRIPTIVE RIGHTS).

175 Ohio St 521, 196 N E 2d 764-769 (1964).

Descriptors: Surface drainage, *Drainage systems, Drainage water, Land development, *Ohio, *Watersheds (Basins), Drainage, Runoff, Streams, *Prescriptive rights, Floods, Flood damage, Diversions, Streamflow, Tiles, Municipal wastes, Surface water.

The court here affirmed a lower court decision dismissing the plaintiffs' petition to enjoin completion of a project to enlarge an existing surface drainage system. The court held that an upstream municipality may collect, by means of sewers, the surface water from a watershed area within the corporate limits and channel it into a natural watercourse which originates in or passes through such watershed area within the municipality, thus increasing the volume and accelerating the flow of water in the watercourse, without incurring liability to the downstream municipalities of landowners. The court also held that a continuous, open and adverse diversion of surface water from one watershed to another ripens into a prescriptive right after the passage of 21 years from the date the water is first discharged into the second watershed. (R. Smith-Fla) W69-00843

CRUTCHER V CRAWFORD LAND COMPANY (LEGISLATION).

For primary bibliographic entry see Field 06E. For abstract, see . W69-00847

DIVISION OF BEACHES AND SHORES: JURISDICTION, BOARD OF CONSERVATION, TRUSTEES OF INTERNAL IMPROVEMENT FUND,

Florida, Office of Attorney General, Tallahassee.

James Kynes.

Rep Att'y Gen Fla, 063-67, June 18, 1963.

Descriptors: *Administrative agencies, Adjudication procedure, *Florida, *Administration, Legislation, Beaches, Shores, State governments, State jurisdiction, *Jurisdiction, Beach erosion, Shore protection.

This opinion was in response to a question from the Director of the Trustees of the Internal Improvement Fund. The Director asked what effect Ch 63-40, Laws of Fla, which established the division of beaches and shores in the board of conservation, would have upon the duties of the Trustees in processing applications for installation of piers, docks, wharves, etc. The Attorney General responded that while the new law represented the most recent expression of legislative will as to who should have responsibility for the protection and restoration of beaches and shores, the structures mentioned by the Director were not for the purpose of restoration, conservation, or preservation of beaches and shores. Therefore the Trustees should continue to process applications for their installation. (R. F. Williams-Fla) W69-00853

SURFACE WATER DATA, ALBERTA, WATER YEAR 1966.

Dep of Energy, Mines and Resources, Inland Waters Branch.

Dep of Energy, Mines, and Resources, Inland Waters Branch, Ottawa, Canada, 1968, 283 p.

Descriptors: *Data collections, *Hydrologic data, *Gaging stations, Streamflow, Discharge (Water), Water year.

Identifiers: Alberta (Canada).

The results of the hydrologic survey of Alberta, Canada, for the 1966 water year are presented. Tabulated data include station descriptions, daily stage or discharge, and summary of monthly and annual data. The station descriptions include location, drainage area, type of gage, period of record, mean discharge, extreme recorded, revisions of previous records, and remarks. (Knapp-USGS) W69-00918

OCCURRENCE OF LARGE NEMATODE POPULATIONS IN IRRIGATION CANALS OF SOUTH CENTRAL WASHINGTON,

Washington State Univ., Prosser.

L. R. Caulkner, and W. J. Bolander. *Nematologia*, Vol 12, pp 591-600, 1966. 12 p. 7 fig, 11 ref, disc. OWRR Project A-011-Wash.

Descriptors: Irrigation canals, Irrigation, *Sampling, Irrigation water, Water analysis, *Nematodes, Analytical techniques, Washington, Plant diseases, Plant pathology, Water pollution effects, *Soil contamination, Columbia River Basin. Identifiers: Plant parasites.

Studies carried out during the 1965 season at Prosser, Washington showed the presence of large numbers of nematodes in irrigation water. Water samples were collected with a depth-adjustable sampling tube and nema were extracted using modified screening and Baermann funnel techniques. Efficiency of the method was inversely proportional to the volume of water sampled. Distribution of nematodes within a canal was random as they did not concentrate in any portion of the canal and no tendency to settle out of flowing water was detected. Population densities in the Sunnyside and Roza Canals ranged from approximately 25 to 200 nema/gal (3.775 1) of water depending upon the date of sampling. Estimates from these data indicate that from 2 to 16 x 10 to the 9th power nematodes per day were carried past a given point. Plant parasitic nematodes generally accounted for 10-20% of those extracted from irrigation water with the highest concentration of these occurring during mid-season in the Sunnyside Canal. W69-01005

DRY VALLEYS AND THE COMPOSITION OF THE DRAINAGE NET,

Exeter Univ. (England), Geography Dept.

K. J. Gregory.

J of Hydrol (Amsterdam), Vol 4, No 4, pp 327-340, November 1966.

Descriptors: *Valleys, *Watersheds (Basins), Channel flow, Linear programming, Drainage systems, *Channel morphology, Arid lands, Streams, *Networks, Regression analysis, *Drainage patterns (Geologic), Stream beds, Hydrologic data, Mapping, Least squares method. Identifiers: Stream channels, Valley network, Drainage nets.

Many drainage basins in Devon, England, particularly in central and southeast Devon, include dry valleys and the problem of the exact composition of the drainage net is often encountered. Two maps were produced for the Otter drainage basin; one showing the existing network of stream channels and one showing the present network of valleys which included many dry valleys devoid of stream channel at the present time. The maps were analysed for number of streams and number of valleys respectively. The best fit by linear regression was provided by the numbers of stream channels mapped in the field. The analysis of the drainage net according to the first two laws of drainage composition showed that the laws were confirmed by the network of present stream channels. In several basins it would appear that the present channel network should be used in preference to the valley network as the latter includes valleys of different ages which developed and functioned at different times. (Blecker-Ariz) W69-01007

4B. Groundwater Management

GAMER V TOWN OF MILTON (PERCOLATING WATER).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00748

HATFIELD TOWNSHIP V LANSDALE MUNICIPAL AUTHORITY (WATER WELLS-REASONABLE USE).

19 Pa D and C 2d 281-299 (Com Pl 1959).

WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Effects on Water of Man's Non-Water Activities—Group 4C

Descriptors: *Reasonable use, Judicial decisions, Water wells, Wells, Percolating water, Cities, Water supply, Ground water, Underground storage, Water table, Competing uses, *Municipal water, Relative rights, *Pennsylvania.

Plaintiff sought a permanent injunction to restrain defendant municipal water company from withdrawing and distributing water to its customers. Defendant proposed to use as its source of water a well which it had obtained by authority of eminent domain proceedings. Plaintiffs alleged that such use adversely affected the wells of neighboring property owners. The court held that the use of waters from the defendant's well must be limited to purposes incidental to the beneficial enjoyment of the land from which they are obtained and if their diversion or sale to others away from the land impairs the supply of water on the property of another, such is not a lawful purpose. The court noted that the municipal nature of the defendant created no distinction in its favor, nor did the fact that the water used was to be furnished to the public put the cause of the defendant in a more favorable position. Although judgment was rendered for the plaintiff injunctive relief was not granted. As an alternative remedy the court required the defendant to supply free water service to the plaintiffs in proportion to their individual losses. (Kuder-Fla)

W69-00784

NORTH CAROLINA WELL CONSTRUCTION ACT.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00795

GROUND WATER RECHARGE AND ITS POTENTIAL,

Texas Technological College, Lubbock.

Marvin J. Dvoracek, and Rolland Z. Wheaton.

Amer Soc of Agr Eng Southwest Reg, 1968. Annual Meeting, Baton Rouge, Louisiana, Apr 1968 (Paper), 1968. 6 p. OWRR Project B-016-Tex.

Descriptors: *Artificial recharge, *Groundwater recharge, Induced infiltration, Pit recharge, Groundwater mining, Injection wells, Recharge wells, Reclaimed water, Water Reuse, Water storage, Playas, Texas.
Identifiers: High Plains, Texas.

The need of and techniques for artificial recharge in areas where groundwater is mined are reviewed. In the High Plains of Texas there is no developed drainage pattern; 2.5-3 million acre-ft of runoff per year collects in playas where 90% of it is lost to evaporation. About 5 million acre-ft a yr of water is being mined. Recharge would slow the lowering of water levels, reduce flooding, and reduce the health hazard of standing waters. Recharge may be by recharge or multipurpose wells, shafts above the water table, pits or trenches, rubble cones, and water-spreading. The best method depends on quantity and quality of water and the physical nature of the aquifer and any overlying formations. Suspended material may clog aquifers as may precipitable dissolved solids, particularly in wells and pits. Clarification of water is often economically justified. Recharge with waste water is practical but may be aesthetically or psychologically disturbing to water users. Nitrates and phosphates may be chemical problems in such waters when they are recharged, but not if they are used for irrigation. Recharge is a means of handling imported water when demand is temporarily below supply. Legal problems involving ownership of recharged water must be solved. (Knapp-USGS)

W69-00928

GEOLOGIC FACTORS IN COMMUNITY DEVELOPMENT AT NAPERVILLE, ILLINOIS, Illinois State Geological Survey.
For primary bibliographic entry see Field 06B.
For abstract, see .

W69-00943

ARTIFICIAL RECHARGE THROUGH AUGMENTED BANK STORAGE,
Princeton Univ., N. J., Civil Eng Dept.
Roger J. M. DeWiest.
Pap, Symp Artif Recharge and Manag of Aquifers, Haifa, Israel, Mar 1967. 28 p, 6 fig, 10 ref. OWRR Project A-011-NJ.

Descriptors: *Groundwater recharge, *Bank storage, Aquifers, Water table, Dams, Trenches, Wells, Hydraulic conductivity, Rivers, New Jersey.

Nonsteady flow is examined for a ground-water recharge project in which rainfall runoff is returned to a water table aquifer in the vicinity of Princeton, N. J. The recharge is accomplished by damming a river and its tributary and by reversing the hydraulic gradient between the river and its connected ground-water basin. Most of the natural recharge to the ground-water table in the area occurs during the rainy season from Nov to late May. With the resulting build-up of ground-water level, effluent discharge to the rivers increases. This increase ultimately is a net loss of fresh water to the ocean. This loss would be reduced significantly by construction of dams. Increased water level in rivers would automatically decrease the hydraulic gradient from ground-water reservoir to the rivers and hence limit the effluent discharge. Simultaneously, the ground-water reservoir would be pumped and this would make available more storage space for retention of a higher percentage of winter-spring rainfall or for quick recharge from flash summer runoff. A geohydrologic description of the watershed is given and various physical parameters entering the study are discussed.

W69-00970

RESEARCH IN GROUND WATER ECONOMICS IN THE HIGH PLAINS AREA OF COLORADO, Colorado State Univ., Fort Collins, Econ Dept.
For primary bibliographic entry see Field 06D.
For abstract, see .

W69-00986

RECONNAISSANCE STUDY OF THE PECOS RIVER BASIN, NEW MEXICO.
New Mexico State Univ., University Park.
John W. Hernandez.
Final Rep, Jan 1967. 4 p, 1 ref. OWRR Project B-003-NMex.

Descriptors: *Ground water, Water resources, River basins, Hydrology, Groundwater geology, Water development, Irrigation, *New Mexico, Mathematical models, Confined water, Systems analysis, Water pollution, River basin development.
Identifiers: Roswell (New Mexico), *Pecos River Basin (New Mexico).

The Pecos River Basin in New Mexico is typical of many in the western United States. The water supply is used almost exclusively for irrigation purposes, irrigation practices include conjunctive use of both surface and ground waters as well as the use of one or the other as a supply, and the ground water in storage is being progressively depleted. Objectives of the project were: (1) to inventory the available water resources, (2) to inventory water resources information and literature available for the Pecos River, N Mex, (3) to review the nature of water resources problems of the basin, and (4) to prepare a comprehensive research proposal designed to generate a decision-making, mathematical model to permit redevelopment of water resources of the basin. The principal water supply problems, particularly those of Roswell groundwater basin were investigated. Because of the geology of the Roswell area, the ground-water system in the area can be studied separately from the water supply of the remainder of the basin. A comprehensive project proposal to develop a model for the optimal utilization of the water supply of the Roswell Basin was prepared based on the information generated in this study.

W69-01134

QUALITY OF THE SHALLOW GROUND WATER IN THE RINCON AND MESILLA VALLEYS, NEW MEXICO AND TEXAS, U S Geological Survey.
J. A. Basler, and L. J. Alary.
U S Geol Surv open-file rep, 30 p, Aug 1968. 4 fig, 2 tab, 6 ref.

Descriptors: *Water quality, *Observation wells, *Sampling, Conductivity, Texas, Pumping, Groundwater movement.

Identifiers: *Rincon and Mesilla Valleys, Specific conductance.

40 observation wells in the Rincon and Messila Valleys, in New Mexico and Texas, were sampled for chemical analysis. These wells were bailed and pumped when capable of sufficient yields, until the field specific conductance of the water from the well had stabilized. Since complex and varying environmental factors, such as drains, canals, and laterals influence the quality of the shallow groundwater in these valleys, the quality cannot be attributed to a single source. Chemical analyses indicate that the quality of the water in the valleys deteriorates with movement downstream, and also deteriorates laterally away from the river. In most places the shallow groundwater is unfit for domestic use but is acceptable for irrigation use. Periodic water-level measurements are made in the wells to observe the general effect of pumping and of surface-water irrigation practices on the shallow water table in the valleys. A figure explains the classification for irrigation use of the shallow groundwater in the area concerned; a map shows the concentrations of selected chemical constituents in the shallow groundwater and the specific conductance of the water at selected sites. (Llavenas-USGS)

W69-01174

MEMORANDUM REPORT ON TEST DRILLING AT NORFOLK VIRGINIA, U S Geol Surv, WRD, Richmond, Virginia.

Donald L. Brown.

U S Geol Surv open-file rep, 28 p, 1968. 2 tab, 1 map.

Descriptors: *Recharge wells, *Underground storage, *Testing, *Aquifers, Observation wells, Water chemistry, Water supply, Municipal water, Hydrologic data, Logging (Recording).
Identifiers: Norfolk (Virginia).

A test well was drilled near Norfolk, Va to explore the feasibility of the storage and retrieval of fresh water after injection into an aquifer containing saline water. The test hole was drilled to a depth of 2,587 ft in unconsolidated sediments. No fresh water was found below 100 ft. A sand suitable geologically and hydrologically for injection was found between 900 and 1,000 ft. It is confined between clay beds and is thick enough to hold enough water to supply Norfolk for a considerable time. The water to be injected and the formation water are probably compatible. The water in the formation contains about 1,000 ppm chloride. A lithologic log of the well is included. Chemical analyses of water samples from various depths in the test hole are tabulated. The location of the well is shown on a map, scale 1:24,000. (Knapp-USGS)

W69-01175

4C. Effects on Water OF Man's Non-Water Activities

AN ACT RELATING TO TOWN ROADS AND COUNTY HIGHWAYS: AMENDING MINNESOTA STATUTES 1965, SECTION 164.07, BY ADDING A SUBDIVISION AND MINNESOTA STATUTES 1965, CHAPTER 163, BY ADDING A SECTION.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00768

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4C—Effects on Water of Man's Non-Water Activities

BOETTLER V BOARD OF TOWNSHIP TRUSTEES (CIVIL RULE OF SURFACE RUFFO).

165 NE 2d 705-712 (C P Summit Co, Ohio 1960).

Descriptors: Water law, Drainage, Drainage water, Drainage control, *Surface runoff, *Surface drainage, Judicial decisions, *Ohio, *Controlled drainage, Drainage systems, Civil law, Drainage effects.

A lower landowner sought equitable relief to require the county to control discharge of surface and stream waters which flowed from higher county land onto the premises of the plaintiff. In constructing an airport the defendant had increased the natural flow of surface waters onto the land of the plaintiff, causing inconvenience and damage. Instead of pursuing his right to injunctive relief, the plaintiff sought to retaliate by constructing a dam and overflow pipe. As a result, large quantities of drainage water were discharged from plaintiff's premises into a ditch adjoining a county road, causing damage to both the ditch and the road. Reciprocal relief was sought by the defendant to enjoin the plaintiff from further damaging its road. In applying the civil rule, the court held that the plaintiff was required to receive only that part of the surface water which naturally passed over his land from the airport. The defendant was therefore held liable for accelerating and diverting surface water over the land of the plaintiff which had no natural outlet on his premises. On the same theory the plaintiff was held liable for damages sustained by the road and ditch. The court apportioned between the plaintiff and defendant the estimated cost necessary to correct and control the drainage situation. (Kuder-Fla)

W69-00782

YOUNG AND SONS, INC V KIRK (MUDFLOW FROM ROAD CONSTRUCTION).

202 Va 176, 116 SE 2d 38-44 (1960).

Descriptors: Drainage, Controlled drainage, Drainage water, *Road construction, Judicial decisions, *Virginia, *Surface drainage, Water law, Construction, *Sediment control, Sediments, Mud, Mudflows, Drainage systems.

Landowners brought an action against defendant contractor for the alleged negligent construction of drainage facilities. While conducting blasting operations in conjunction with a state highway project, defendant constructed facilities to drain diffuse surface water from the construction area. Plaintiff alleged that the drainage facilities were negligently constructed and inadequate to accommodate the volume of water that might reasonably be expected to accumulate in the area. Consequently large quantities of mud had accumulated, damaging the land of the plaintiff and contaminating his water supply. Judgment for the plaintiff was appealed on the ground of insufficient evidence. The court held that the evidence was sufficient to establish the liability of the defendant. (Kuder-Fla)

W69-00785

BODIN V GILL (WATER DAMAGE THROUGH NEGLIGENCE DESIGN).

216 Ga 467, 117 S E 2d 325-331 (1960).

Descriptors: *Georgia, Judicial decisions, *Surface runoff, Soil erosion, Depreciation, *Damages, *Contours (Flow control), Architecture (Design), Ponding, Drainage systems, Overflow, Abatement (Flood control). Identifiers: *Injunctions.

Plaintiff sought an injunction and damages against architects, church and contractor. The plaintiff alleged that the defendants, by altering the contours of the church property in building a new church, had caused water in unnaturally high amounts to run upon and damage the plaintiff's property. The court granted a temporary injunction against all defendants so they could attempt to correct the

damaging condition. The architects appealed. This court held the architects could be held for damages for negligent performance of their profession in allowing the faulty design to be put into effect. The ruling was reversed as far as it named the architects as co-respondents to the injunction. Since the architects had completed their portion of the contract and turning the property over to the church some months prior to the plaintiff's suit, they could not have legally disturbed the church's exclusive possession of the land to correct the condition created by their faulty methods. This being so they could not be enjoined at a later date against subsequent injury to the plaintiff's property. (Blunt-Fla)

W69-00786

HOLLEY V STATE (OBSTRUCTION OF DRAINAGE).

128 So 2d 908-911 (Ct App La 1961).

Descriptors: *Floods, *Flood damage, *Drainage, Surface drainage, *Louisiana, Legal aspects.

The plaintiff claimed the highway department's negligent construction of a highway caused an obstruction to natural drainage resulting in the inundation of the plaintiff's property. The court held it incumbent upon the plaintiff to establish by strong, clear and convincing proof that the alleged damages were caused by the defendant's installation of inadequate drainage structures along the highway. The court considered the evidence and decided that the flooding was not due to the insufficiency of openings in the highway. (Horner-Fla)

W69-00789

OFFENSES CONCERNING PUBLIC ROADS AND NAVIGABLE WATERS.

Fla Stat 861.01-861.06 (1967).

Descriptors: *Florida, Legislation, *Obstruction to flow, *Navigable waters, Dams, Non-navigable waters, Damages, Harbors, Water hyacinth, Bridges, Boats, Streams, Dam failure.

Identifiers: Crimes.

Section 861.02 of the Florida Statutes provides a fine of \$100 for obstructing a navigable watercourse so that the passage of fish or of boats drawing three feet of water is impaired. Section 861.03 provides a fine of \$10,000 and/or imprisonment not exceeding twenty years for willful destruction of a dam used for propelling machinery on any stream within the State. Section 861.04 provides for imprisonment of ninety days and/or a fine of \$200 for willfully placing water hyacinths in any of the streams or waters of the state. Section 861.05 provides a fine of \$5000 for obstruction of navigable waters by any bridge, whether constructed or to be constructed. Section 861.06 provides imprisonment of two years and/or a fine of \$1000 for obstructing a harbor by a steamer, vessel, barge, or lighter; or by any person who violates the provisions of the law relative to the protection of harbors. (Crabtree-Fla)

W69-00855

HARRISON COUNTY V GUICE (OWNERSHIP OF ARTIFICIAL BEACH).

140 So 2d 838-843 (Miss 1962).

Descriptors: Mississippi, Judicial decisions, *Easements, Highwater mark, Right-of-way, Highways, Beaches, *Sea walls, Shore protection, *Acretion (Legal aspects), Riparian rights.

Identifiers: *Littoral rights, Upland owner, Counties.

It was held that where a county acquired an easement for construction of a seawall for protection of a highway and an easement to replace, repair and maintain the seawall and highway, the easement was so limited and no other estate in the lands was

acquired. The county condemned a 50-foot strip of land for a right-of-way for construction of a seawall for protection of a highway and such wall was constructed in 1927. In 1951 the county constructed a sloping beach for further protection of the seawall. Since this was not within the easement, the upland owner acquired the beach to the highwater mark in fee simple. (Crabtree-Fla)

W69-00856

BARDWELL V MANISCALCO (DAMAGES FOR OBSTRUCTING SURFACE WATERS).

135 So 2d 84-87 (La 1961).

Descriptors: Louisiana, Judicial decisions, Dams, *Obstruction to flow, *Encroachment, Damages, *Overflow, Ponds, *Dam construction, Laterals, Surface runoff.

Identifiers: Nominal damages.

This was an action for damages resulting from defendant's construction of a dam that encroached on plaintiff's land, obstructed surface flow, and caused an overflow of water onto plaintiff's land. Plaintiff prevailed for nominal damages only because he failed to prove the amount of actual damage. Plaintiff had agreed to the dam construction, but of a smaller dam which was to be totally on defendant's land. (Crabtree-Fla)

W69-00860

GROMMES V TOWN OF AURORA (SURFACE DRAINAGE).

37 111 App 2d 1; 185 N E 2d 3-9 (1962).

Descriptors: Surface runoff, Drainage, *Culverts, Rain water, Surface water, Flooding, Drainage water, Damages, *Illinois, Surface drainage, *Roads, Road construction, Road design, Cultivated lands, Flood damage, Farms, Crops.

Plaintiffs sued defendants for damages resulting from a highway improvement which plaintiffs alleged interfered with the drainage of their farms. A jury returned a verdict for the plaintiffs and defendants appealed. The evidence discloses that the normal drainage of the lands in question was westward from Grommes Farm, then southward across the tract farmed by Schoger, over or under the township road and then southerly to Blackberry Creek. Before the road was resurfaced, plaintiffs had never lost a crop due to flooding. The court affirmed the decision on the basis that a municipal corporation in the management of its property is held to the same responsibility that attaches to individuals for injury to the property of others. (R. Smith-Fla)

W69-00862

MUNN V HORVITZ CO (INJUNCTION AGAINST STORM SEWER MAINTENANCE).

184 N E 2d 231-239 (Ohio 1962).

Descriptors: *Judicial decisions, *Ohio, Cities, *Prescriptive rights, Surface runoff, Surface drainage, Storm runoff, *Storm drains, Conduits, Conveyance structures, Drainage systems.

Identifiers: Injunctions.

Plaintiff brought suit to enjoin the completion of a project to enlarge a storm sewer emptying into a creek which ran past plaintiff's property. The sewer system had been originally constructed in 1925 by county authorities. Since that time, the area draining into the sewer had greatly changed in character, from rural to residential and commercial, with streets, shopping centers and parking lots. The court heard much detailed and technical evidence. The court held that the county and city had gained a prescriptive right to continue to use the sewer, together with the right to make improvements thereto necessitated by development of the drainage area by private individuals and by the construction of public improvements. The use of the

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sewer had been continuous, open and notorious for over 37 years. The court also pointed out that plaintiff had an adequate remedy at law for any damages sustained from wrongful acts by defendants, and that therefore injunctive relief was not warranted. (R. F. Williams-Fla)
W69-00864

LUNEAU V MACDONALD (PROPERTY BOUNDARIES).

173 A 2d 44-47 (N H 1961).

Descriptors: *New Hampshire, Judicial decisions, Boundaries (Property), *Boundary disputes, Thread of the stream, Public water rights, Local governments.

Plaintiff owned property bordered on the west by a lake. The eastern boundary was a publicly owned road. The south boundary was a line between the lake shore line and the road. The shore line and the road met at the northern boundary forming a triangular piece of property. Plaintiff seeks to prevent defendant from using a wharf located at the northern boundary of the plaintiff's property. When property conveyed is bounded by a stream or highway, it is presumed the property runs to the thread of the stream or the center of the highway. But the city owned the road and thus the rights to the shore line at the northern tip of the plaintiff's property. When a wharf is built on navigable water and bounded by publicly owned property, only an official of the public can bring an action to prevent the use of the wharf. Individuals do not have standing to enforce the public rights. (Headley-Fla)
W69-00867

KERBER V MERRIT CONSTRUCTION CO (RESIDENTIAL CONSTRUCTION EFFECTS ON WATER FLOW).

44 Westmoreland L J 155-161 (Pa Com Pl 1962).

Descriptors: *Judicial decisions, *Pennsylvania, Reasonable use, *Surface runoff, Drainage, Drainage water, *Surface drainage, Relative rights, Water law, Legal aspects.

In this case the defendant was a construction company and the owner of a dominant estate. Plaintiff, a farmer, owned a servient estate, and contended that the construction by defendant of a road with drainage pipes under it which emptied onto plaintiff's property, caused damage to his property. The court found that drainage had always flowed from defendant's property onto that of plaintiff, and that plaintiff's property was the only property in the area which had not been developed for residential purposes. The court further found that defendants' development of its land for residential purposes was a normal, reasonable, and appropriate use of the land, which did not increase the quantity of water discharged on plaintiff's property or the points where it was discharged. It held that under these circumstances the plaintiff was not entitled to damages. Only where the upper owner is guilty of negligence, causing unnecessary damage to the lower owner, or where the upper owner precipitated collected surface water in greatly increased quantities upon the lower owner that damages will be awarded. (R. F. Williams-Fla)
W69-00870

LOEHDE V WISCONSIN RIVER POWER CO (DAMAGE TO FLOODED LAND).

304 F 2d 433-436 (7 CCA 1962).

Descriptors: *Flooding, *Dam construction, *Damages, Seepage, Dams, Erosion, Percolating water, Water law, Legal aspects.

The plaintiff owned a tract of scrub land downstream from the defendants' dam. The defendant extracted soil from the plaintiff's land in building the dam which resulted in the partial inundation of the tract. The court held that the difference

between the values of the land before and the value of the land afterwards was the proper measure of damages for the partial inundation of property by percolating waters, created by a dam. The plaintiff was also entitled to an injunction preventing further erosion of his land. (Horner-Fla)
W69-00874

BARDWELL V MANISCALCO (DAM CAUSING WATER ENCROACHMENT).

135 So 2d 84-87 (Ct App La 1961).

Descriptors: *Louisiana, *Dams, *Backwater, Dam construction, Judicial decisions, Encroachment. Identifiers: Damages (Legal aspects).

Plaintiff brought suit against defendant adjoining landowner for alleged damages resulting from a dam constructed by defendant which partially encroached on plaintiff's land. Natural drainage had been from plaintiff's to defendant's land, into a natural pond partially on the land of both. Plaintiff consented to defendant's proposed construction of the dam as long as it did not encroach on his land. However, the dam was much larger than plaintiff claimed they agreed upon and both encroached on plaintiff's land and caused water to back up on his land. Defendant answered that plaintiff saw all of the construction as it progressed and did not complain, thereby manifesting his implied consent. The trial court found for plaintiff, but awarded only nominal damages. The appeal was concerned only with the question of damages. (R. F. Williams-Fla)
W69-00879

KLUTEY V COMMONWEALTH DEPT OF HIGHWAYS (EFFECT ON WATER OF HIGHWAY CONSTRUCTION).

428 S W 2d 766-772 (Ct App Ky 1968).

Descriptors: *Diversion structures, *Drainage waters, *Civil law, Kentucky, Natural flow doctrine, Judicial decisions, *Riddance (Legal aspects), Drainage programs, Drainage effects, Comparative benefits, Repulsion (Legal aspects).

This was an action for injunction by the state. Appellant counterclaimed for injunction against the state, claiming that two drainage culverts, constructed under a new highway, accelerated the flow of water onto their lands, cutting deep ditches and creating a flooding condition. Assuming the state to be in the position of an adjoining land owner, and departing from the civil law rule that the upland owner could not erect artificial structures altering the water flow to the lower estate, the court held that the appellants (lower land owners) could prevail only if the state (upper land owner) unreasonably changed that natural flow, causing unnatural volumes or unusually swift flows on the lower land. The test was balancing the reasonableness of use by the upper owner against the severity of damage to the servient owner. In determining the right of the lower owner to recover, four considerations were proposed: (1) necessity of drainage; (2) care taken to avoid unnecessary damage to lower land; (3) benefit to the land drained vis-a-vis detriment to lower land; (4) improvement of natural drainage or adoption of a reasonable artificial system. One judge dissented. (Storage-Fla)
W69-00882

CISSELL V GRIMES INVESTMENTS INC (DRAINAGE EFFECTS).

383 S W 2d 128-130 (Ky 1964).

Descriptors: Surface drainage, Ditches, *Drainage effects, Surface waters, *Ponds, Natural flow, Land development, Culverts, Sewers, Diversion, Surface, Runoff, Erosion, *Kentucky.

The appeal is from a judgment refusing to grant the appellants injunctive relief and damages against the appellees. The tract of land being developed as a

subdivision by the appellees lies on the west side of Ormsby Lane. The land owned by appellants is located on the east side of Ormsby Lane. The natural drainage from the appellee's tract is across the appellants property and into Big Goose Creek. In developing the subdivision appellees caused a shallow artificial pond to be eliminated. The court stated that the rule in Kentucky permits the owner of an upper estate to drain and ditch his land for the purpose of carrying off surface water into natural channels by building sewers, gutters and culverts thereon, without liability to the owner of the lower estate, even though such methods of ridding his property of surface water accelerate and increase the flow of water onto the lower estate, so long as he does not divert water from natural drains which otherwise would not have flowed onto the lower estate. On the basis of the above rule the court affirmed the order. (R. Smith-Fla)
W69-00883

GROSSMAN V JENAD, INC (FLOODING BY ARTIFICIAL CHANNELS).

198 NYS 2d 218-230 (Sup Ct 1960).

Descriptors: *New York, Damages, Flooding, *Artificial watercourses, Flow, Dams, Drainage systems, Judicial decisions, Water law, Civil law, Culverts, Developed waters, Sluices, *Alteration of flow, Streamflow, *Natural flow doctrine, Overflow, Diversion structures.

A man-made pond on defendant's property, constructed for the purpose of collecting water from the surrounding terrain, opened by means of a concrete headwall and sluice gate constructed by defendant into a stream that ran across plaintiff's property. Defendant, a land developer, constructed additional artificial channels and pipes which diverted certain surface waters into the stream. Plaintiff sustained damages caused by the greater force and volume resulting from this unnatural increased flow of water. The stream had formerly been clear and gentle; after the artificial channels and pipes were constructed, the water carried dirt and debris, the banks became eroded and the riprapping became undermined. The court stated that any natural or normal alteration of one's land through reasonable improvements which results in casting surface waters upon the land of another creates no liability unless such surface waters are so collected in drains, pipes, or ditches and cast onto another's premises. Holding that the damages were caused by the artificial channels rather than from heavy rains alone, the court found for the plaintiff in the amount necessary to alter his property to carry off the additional volume of water caused by defendant's installation of the artificial channels. (S. Scott-Fla)
W69-00884

MUEHLHAUSEN V DELAWARE VALLEY HOLDING CO (NEGLIGENT WATERCOURSE RELOCATION).

9 Bucks Co L Rep.

Descriptors: Civil law, Judicial decisions, Legal aspects, Ownership of beds, Relocation, Social needs, Water law, Watercourses, Diversion, Reasonable use, Relative rights, Streamflow, Alluvium, Erosion, *Relocation, *Pennsylvania, Landscaping, Sedimentation, Silting, Riparian rights, *Damages.

A rock-bottomed, fast-running stream ran through plaintiffs' wooded property. Plaintiffs widened and deepened the watercourse and constructed small dams and spillways, creating small pools and a controlled flow of clear and wholesome water with little or no sediment or alluvial matter. The watercourse in question ran across defendant's land in an irregular course and directly onto plaintiffs' property. Defendant relocated the channel, but took no precautions to prevent wash or erosion of the new channel, even though the old channel's bed and banks were rock, while those of the new channel were largely dirt. As a consequence, large

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amounts of silt and other eroded matter were deposited within the streambed on plaintiffs' property, filling all its pools. The court held that the defendant had been negligent in relocating the watercourse, and was liable to plaintiffs for the costs of removing the deposits from plaintiffs' land. It is incumbent upon one changing the natural channel of a watercourse to exercise due care in providing and maintaining the substituted channel. (S. Scott-Fla)
W69-00886

JEFFERY V LATHRUP (RELOCATION OF TILE DRAIN).

363 Mich 15, 108 NW 2d 827-831 (1961).

Descriptors: *Michigan, Civil law, Judicial decisions, *Easements, Drainage, Controlled drainage, Tile drainage, Tiles, Surface runoff, Tile drains, *Relocation, Damages, Septic tanks, Saturation, Market value.

Plaintiff purchased a home from defendant, a real-estate developer. At the time of the purchase, the plat for the subdivision showed a 20 foot easement for drainage running over the rear of plaintiff's property and diagonally across the adjacent lot owned by defendant. There was an 8 inch tile line in this easement. Plaintiff had no drainage problems for three years, until defendant relocated the tile drain in preparation for construction of a house squarely across the easement for drainage shown on the plat. As a result, plaintiff suffered damages consisting of saturation and back pressure in his septic tank, causing the toilets and drains in his house to malfunction, and the basement to flood through a floor drain. The court held that under such circumstances defendant would be liable for either present or future damages, or for an amount representing permanent impairment of the value of plaintiff's property. (S. Scott-Fla)
W69-00888

GOLOSKIE V LA LANCETTE (RIPARIAN RIGHTS IN ARTIFICIAL POND).

163 A 2d 325-330 (RI 1960).

Descriptors: *Rhode Island, Judicial decisions, Dams, Riparian rights, Navigable waters, Ownership of beds, Relative rights, Riparian land, Riparian waters, *Farm ponds, Multiple-purpose reservoirs, Ponds, Recreation, Artificial watercourses.

The complainant created an artificial pond on his property by damming up a small brook. He is seeking to enjoin the respondent, who claims a right as a riparian owner to fish and swim in the pond, from trespassing on the pond. In order to have the riparian rights claimed by respondent, it must be shown by evidence that the pond is fed by a navigable river. No such evidence was presented in this case. The fact of flowage from the pond will not bring the shores of the pond to the property bordering such pond. The respondent is not entitled to the riparian rights he claims. (Headley-Fla)
W69-00891

ALLIANCE FOR CONSERVATION OF NATURAL RESOURCES IN PINELLAS COUNTY V FUREN (REVIEW OF ORDER OF COUNTY WATER AND NAVIGATION AUTHORITY ALLOWING FILLING OF SUBMERGED LANDS).

122 So 2d 51-67 (Fla DCA 1960).

Descriptors: Judicial decisions, *Florida, *Beds, Navigable waters, *Landfills, Legislation, Islands, Overflow, Sand bars, Swamps, Standards, Transportation, Recreation, Channels, Erosion control.

The Pinellas County Water and Navigation Control Authority is authorized to regulate and exercise control over the dredging and filling of all submerged bottom lands in the county, together with all islands, sandbars, swamp and overflow lands. The act which created the authority sets up 8 standards which must be met before the authority can

grant permission to fill submerged lands. These standards deal with the effect of the proposed plan on such things as transportation, recreation, erosion control, the flow of water, natural beauty, wild life, and other natural resources. If the petition meets these standards then the authority has no alternative but to grant permission. The court determined that the evidence presented at the original hearing supported the granting of permission and the decision of the lower court was affirmed. (R. H. Watson-Fla)
W69-00896

CH 215 - AN ACT RELATING TO EXCAVATING, FILLING AND DREDGING IN AND ADJACENT TO TIDAL WATERS.

Laws of New Hampshire 1967, ch 215, 2 p.

Descriptors: *Legislation, *New Hampshire, Water pollution, Administrative agencies, Landfills, *Dredging, Mining, Excavation, *Tidal waters, Banks, Marshes, Swamps, Aquatic habitats, Bulkheads, Runoff, Shellfish, Marine fisheries, Wildlife. Identifiers: Equity.

New Hampshire requires that any person who intends to excavate, remove, fill or dredge any bank, flat, marsh, or swamp in and adjacent to tidal waters submit plans of such proposal to the New Hampshire Port Authority at least 30 days prior to the beginning of the work. The Port Authority will hold a public hearing on the proposed project. After the hearing the authority may deny the petition, or may require the installation of bulkheads or other containment structures to prevent subsequent fill runoff back into tidal waters. If the area on which the proposed work is to be done contains shellfish or marine fisheries and wildlife, the director of the N H fish and game department may impose such conditions as he deems necessary for their protection. Any person who violates this statute may be liable for removal of all fill and subject to a maximum fine of \$1,000. (R. H. Watson-Fla)
W69-00904

AN ACT RELATIVE TO EXCAVATING AND DREDGING IN PUBLIC WATERS.

Laws of New Hampshire 1967, Ch 274.

Descriptors: *New Hampshire, Legislation, State jurisdiction, Administrative agencies, Administrative decisions, Adjudication procedure, Public rights, High water mark, *Beds under water, *Dredging, *Permits. Identifiers: Public waters.

A new chapter, 488-A, is added. It provides that no one shall excavate, dredge, or remove any bank, flat, marsh, swamp or lake bed lying below the natural mean high water mark of any public waters, except as therein provided. Natural ponds of more than ten acres are declared to be public waters. An owner of a shore line on public waters may petition the governor and council for permission to dredge in front of his property. The governor and council may grant such permission, upon recommendation of the water resources board and payment of just compensation. Hearings by the water resources board are provided for. A penalty for noncompliance is provided for. The petitioner must pay the costs of the hearings. (R. F. Williams-Fla)
W69-00905

CH 307 - AN ACT RELATIVE TO PLACING FILL IN PUBLIC WATERS.

Laws of New Hampshire 1967, Ch 307, 3 p.

Descriptors: *Legislation, *New Hampshire, Landfills, Administrative agencies, Water resources development, Ponds, High water mark, Federal government, Piers, Beds. Identifiers: Public waters.

New Hampshire generally prohibits placing fill in public waters. Public waters include all natural ponds of more than ten acres and all rivers and streams. This prohibition does not apply to the state, federal, or local governments. The governor and council, upon petition and upon recommendation of the water resources board, may, for just consideration, grant to an owner of shoreline on public waters, the right to place fill in the bed of such waters in front of his shoreline. The statute outlines the procedure for obtaining permission to fill. It includes a hearing and publication of the hearing. All costs of the hearing are to be paid by the person soliciting permission. If a person places fill in public waters without permission he is subject to a fine not to exceed \$1,000 and may be compelled to remove the fill by the superior court. (R. H. Watson-Fla)
W69-00906

4D. Watershed Protection

LOCAL ACTION AND ACCEPTANCE OF WATERSHED DEVELOPMENT,

Mississippi State Univ., State College.
Kenneth P. Wilkinson.

Water Resour Res Inst Rep, 1966, 43 p, 7 tab, 32 ref, append. OWRR Project A-008-Miss.

Descriptors: *Watersheds, *Public opinion, Social values, Participating funds, Land ownership, *Questionnaires, *Flood control, *Soil erosion, *Watershed management, Social aspects, Social participation.

This is an exploratory study of effects of community structure on projects of watershed development. Case studies were conducted in 2 communities in which community structure had been examined in previous research. In one community, where action in other areas of interest had been carried on primarily in special-interest fields, actors in the watershed program were successful in programmed efforts to secure local resources. In the second community generalized community leaders were involved primarily in initiation of the watershed project. A higher level of physical accomplishment was reached in the project in the former and attitudes of rural landowners toward watershed development were more favorable. Findings suggest that technical, special-interest projects, such as watershed development, operate more smoothly where community structure is less integrated. Research concerned with a large number of communities and a variety of watershed projects is needed to specify the optimal level of contact and the conditions under which that level is approached.

W69-00716

AN ACT PROVIDING FOR THE CREATION OF WATERSHED CONSERVATION DISTRICTS.

South Carolina Laws 1967, No 613.

Descriptors: *South Carolina, Legislation, Administrative agencies, *Water districts, *Water conservation, State governments, Government finance, Taxes, Assessments. Identifiers: Referendum.

Watershed conservation districts may be established within soil and water conservation districts. They may execute plans and programs to control or prevent soil erosion and floods for the conservation, development and utilization of soil and water resources, and for the disposal of water. Watershed conservation districts may be requested by petition from the residents of the area of the proposed district to the soil and water conservation district wherein such area lies. The area involved must be contiguous, within a clearly defined watershed and shall not include lands within a town or other watershed conservation district. Notice and a public hearing on the desirability of such a district are required, as is a referendum of the electors within the proposed district. If the electors approve of the creation of such district, a governing

Identification of Pollutants—Group 5A

body of five members is to be elected. The districts are empowered to acquire and dispose of land, construct and maintain works of improvement, borrow money, sue and be sued, and to levy an annual tax. Procedures and limitations on these powers are set out. Provision is made for the discontinuance, by referendum, of watershed conservation districts. (R. F. Williams-Fla) W69-00793

AN ACT TO ENTER INTO THE CHAMPLAIN BASIN COMPACT, ESTABLISH A COMMISSION TO REPRESENT VERMONT AND REPEAL 10 V S A SECS 172-184.

Laws of Vermont 1967, No 93. 14 p.

Descriptors: *Vermont, *Legislation, New York, Administrative agencies, *Interstate compacts, *Watersheds (Basins), Grants, Budgeting, Financing, Watershed management, Water resources development, Water conservation. Identifiers: Champlain Basin Compact.

The legislatures of New York and Vermont, having recognized the need for a regional inter-governmental forum for consideration of the problems and coordination of governmental activities in the Champlain Basin, drafted the Champlain Basin Compact. This statute adopts the compact by Vermont, and contains a copy of the compact. New York and Vermont are the original members of the compact, but it also provides for membership of Canada if adopted. The compact provides for general watershed management. The Champlain Basin is defined. Details of the compact are given including finance, development plans, and creation of Lake Champlain Park. (R. H. Watson-Fla) W69-00900

RATE OF SOLUTION OF LIMESTONE IN THE KARST TERRANE OF FLORIDA,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-00997

WATER MANAGEMENT ON SEMIARID WATERSHEDS,
Dept. of Agriculture, Tucson, Agricultural Research Service.
R. B. Hickok.
17th Annu Ariz Watershed Symp Proc, 1967, pp 9-14. 6 p, 12 fig.

Descriptors: Arizona, *Water management (Applied), *Watershed management, *Semi-arid climates, Flash floods, *Sediment discharge, Watersheds (Divides), Economic impact, Erosion control, *Rainfall-runoff relationships, Water utilization, Water yield improvement. Identifiers: *Walnut Gulch Experimental Watershed (Arizona), Experimental watersheds.

Research conducted on the 58-square-mile Walnut Gulch Experimental Watershed at Tombstone, Arizona, was used to determine optimum utilization of available water, whether on or off the watershed, and control of flash flood and sediment damage. Basic hydrologic processes involved were studied, including their interrelationships and their reaction to various watershed conditions. This basic information was used for predicting and improving behavior of other semi-arid rangeland watersheds throughout the Southwest. (Blecker-Ariz) W69-01022

USDA REPORT ON WATER AND RELATED LAND RESOURCES, POWDER DRAINAGE BASIN, OREGON.
U. S. Department of Agriculture, and Oregon State Water Resources Board, Salem.

U. S. Dep of Agr, Econ Res Serv, 132 p, Jan 1966. 13 fig, 8 map, 33 photo, 26 tab.

Descriptors: *Watersheds (Basins), *Land resources, *Watershed management, *Oregon, Range management, Forest management, Agricultural watersheds.

Identifiers: Flood prevention.

Erosion, flooding, drainage and other water-related problems of the Powder Drainage Basin, Oregon, were assessed in relation to future requirements for water and land resources. Previously recorded data were collected and evaluated; in addition, the USDA River Basin Survey Staff made limited studies to gather basic data not otherwise available, such as physical characteristics of certain reservoir sites, land and water availability and use, needs for tributary watersheds, and forest land resources and ownership. Watershed protection is discussed in relation to agriculture, rangeland, and forestry. Agricultural use of both groundwater and surface water is emphasized. Pertinent tabular data are provided as background information for future work envisaged. (Llaverias-USGS) W69-01184

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification OF Pollutants

RADIOACTIVITY IN WASHINGTON SURFACE WATER, JULY 1966-JUNE 1967.

Washington State Department of Health, Seattle.

Radiol Health Data and Rep, Vol 9, No 8, pp 438-442, Aug 1968. 5 p, 1 fig, 4 tab, 6 ref.

Descriptors: *Data collections, *Radioactivity, *Monitoring, *Surface waters, Water quality, Radiochemical analysis, Washington, Analytical techniques.

Data from radioanalysis of surface water samples collected in the State of Washington are tabulated. Of the 175 river water samples analyzed in 1966-67, excluding the Columbia River, the total beta radioactivity ranged from 1-26 pCi/liter and averaged 3.0. Radioactivity of the suspended fraction ranged from less than 1 to 17 pCi/liter and averaged less than 1. Radioactivity of the soluble fraction ranged from less than 1 to 10 pCi/liter and averaged 1.8. Average beta radioactivity of the Columbia below Hanford ranged from 5 to 308 pCi/liter. Phosphorus-32 concentration ranged from less than 1 to 360 pCi/liter. Gamma emitters ranged from less than 50 to 127 pCi/liter for ruthenium-106, less than 5 to less than 20 for zirconium-95, less than 100 to 8,458 for chromium-51, and less than 20 to 466 for zinc-65. (Knapp-USGS) W69-00916

INSECTICIDE ADSORPTION BY LAKE SEDIMENTS AS A FACTOR CONTROLLING INSECTICIDE ACCUMULATION IN LAKES,

Wisconsin University, Madison, Soils Dept.

G. Chesters.

Rep of Phase 2 of project. Rep of Office of Water Resources Res, Wis Univ, Madison. 14 p, 4 tab, 4 fig, 2 attach. August 1968, OWRR Project B-016-Wis.

Descriptors: *Insecticides, *Adsorption, *Lakes, *Sediments, Clays, Organic matter, Chemical degradation, Hydrolysis, Pesticide kinetics, Methodology.

Identifiers: Malathion, Parathion, Lindane.

Investigation of the adsorption of insecticides on lake sediments as a factor controlling insecticide accumulation in lakes is reported. Reprints of 2 Journal papers are attached to and form a part of this report; one describes a quantitative method for unified extraction of organochlorine and or-

ganophosphate insecticides from lake waters and the other reports on determination of lindane adsorption on 8 intact lake sediments using a radiochemical technique. Methods developed for extraction and analysis of insecticides ranged in effectiveness from 81-88% for heptachlor to 93.9-102.4% for most other commonly used insecticides. Lindane adsorption was affected by suspended sediment concentration, organic content, lindane concentration and clay content. Adsorption is decreased in the presence of iron oxides, possibly because oxide coatings on clay particles interfere with surface OH bonding. Adsorption in separate sediment fractions decreases with increasing particle size. Malathion adsorption is largely controlled by organic content of sediment. In separate sediment fractions, however, malathion adsorption decreased with increasing particle size and iron oxide content. Lindane degradation is faster under anaerobic than aerobic conditions. Parathion decomposes by hydrolysis in a first-order reaction with a half-life of about 50 hours. (Lang-USGS) W69-00921

GROSS RADIOACTIVITY IN SURFACE WATERS OF THE UNITED STATES, FEBRUARY 1968.

Division of Pollution Surveillance, Federal Water Pollution Control Administration, Washington, D. C.

Radiol Health Data and Rep, Vol 9, No 8, pp 436-437, Aug 1968. 2 p, 1 fig, 1 tab, 7 ref.

Descriptors: *Data collections, *Radioactivity, *Monitoring, *Surface waters, Water quality, Radiochemical analysis.

The data obtained in the monitoring of levels of radioactivity in surface waters of the U S in Feb 1968 are tabulated. The radioactivity of dissolved solids alone roughly indicates levels in treated water because nearly all suspended matter is removed in treatment. Strontium-90 results are reported semi-annually. Special note is made when alpha radioactivity concentration is 15 pCi/liter or more and when beta radioactivity concentration is 150 pCi/liter or more. In Feb 1968, the Arkansas River at Coolidge, Kansas, the North Platte at Henry, Nebraska, and the South Platte at Julesburg, Colorado exceeded 15 pCi in alpha radioactivity concentration. (Knapp-USGS) W69-00933

THE ANALYSIS OF AROMATIC COMPOUNDS IN WATER USING FLUORESCENCE AND PHOSPHORESCENCE.

New Hampshire Univ, Durham.

David W. Ellis.

Prog Rep, Phase I, 1968. 24 p, 1 fig, 1 tab, 21 ref. OWRR Project A-009-NH.

Descriptors: *Aromatic compounds, *Water analysis, Chemical analysis, Gas chromatography, Spectrophotometry, *Spectrometers, Fluorescence, *Fluorometry, Temperature, Instrumentation, Aromatic solvents, Chromatography.

The paper is a progress report covering the first phase of an investigation using a commercial spectrofluorometer/spectrophosphorimeter for analyzing aromatic compounds in water. The object of the investigation is to develop a basic method for analysis of aromatic compounds. Pesticide analysis Grade n-pentane was selected as the solvent for extraction. The report covers: Extraction and concentration, column chromatographic removal of basic components, thin-layer chromatographic separation and identification, fluorescence analysis, gas chromatographic analysis, mass spectrometer, and nitromethane extraction. Planned research for the remainder of the first phase is given. W69-01114

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

VIRUS INACTIVATION ON CLAY PARTICLES IN NATURAL WATERS,

Metcalf and Eddy, Boston, Mass., and Maine Univ., Orono.

George F. Carlson, Jr., Franklin E. Woodard, and David F. Wentworth.

Supported in part by U S Dept of the Int, WRA 1964 and FWPCA Grad Tr Grant and Res Grant. J Water Pollut Contr Federation, Vol 40, No 2, Part 2, pp R89-R106, Feb 1968. 18 p, 9 fig, 10 tab, 19 ref. OWRR Project A-004-ME.

Descriptors: *Water pollution, *Viruses, Aquatic microbiology, Clays, Suspension, Turbidity.

Identifiers: *Virus inactivation, Adsorption virus.

Research was conducted on the inactivation of viruses in clay particles suspensions as affected by various conditions found in natural streams. Of special interest were the primary inactivation mechanism, the effect of varying ionic strength with different clays, and the effect of organic macromolecular substances on inactivation. Viruses used in research were: bacteriophage T2, against Escherichia coli strain B, and type 1 poliovirus. The poliovirus was titered by the plaque technique. All clay particles were centrifuged from the observed virus inactivation. To evaluate the applicability of these basic research results to the natural situation, natural river turbidity collected from the Missouri River was resuspended in tap-water and experiments were conducted with varying amounts of calcium chloride. The effects of centrifugation to remove clay particles are discussed. Among the many experimental findings listed, it is stated that the adsorption of virus onto clay particles was proven to be reversible; thus, viruses adsorbed onto clay are inactivated only temporarily. (Llaverias-USGS)

W69-01185

5B. Sources of Pollution

THE MOVEMENT OF RADIONUCLIDES THROUGH SOIL FORMATIONS,

Iowa State Univ., Ames.

Charles A. Culman, and Lyle V. A. Sendlein.

Eng Res Inst Rept, Jan 1968. 27 p, 12 fig, 1 map. OWRR Project A-011-la.

Descriptors: Geologic mapping, *Radioisotopes, Soil physical properties, *Tracers, Subsurface investigations, *Radioactive wastes, Radioactive waste disposal, Geologic investigations, Foundations, Permeability, Seepage, Adsorption.

A study was made on the site of the Ames Laboratory Research Reactor to gather basic information needed in planning future field studies concerned with the movement of radionuclides through soil. Soil and bed rock in the area were mapped by outcrop studies and by electroresistivity and seismic measurements. Six bore holes were drilled to provide control for indirect geophysical measurements. The physical properties of soils from the B-horizon and from a gully used for waste water disposal were investigated. Tracer studies were made on disturbed and undisturbed soil samples in the laboratory by percolating spiked solutions through soil columns to determine the uptake of strontium and cesium. Batch tests were also made to develop the adsorption isotherms of the soil for strontium and cesium.

W69-00708

VIRUS INACTIVATION IN NATURAL WATERS. 1. VIRUS INACTIVATION ON CLAY PARTICLES,

Maine Univ., Orono.

G. F. Carlson, Jr., F. E. Woodard, and O. J. Sproul.

39th Annu Conf, Water Pollut Contr Fed, Kansas City, Mo, Sept 1966. 47 p, 9 fig, 10 tab, 19 ref. OWRR Project A-004-Me.

Descriptors: *Viruses, Microorganisms, *Bacteriophage, Biocontrol, Diseases, Microbiology, Water pollution sources, Public health, Clay.

The objective of this research was to investigate the adsorption of virus to several different types of clays. The experimental virus used was T2 Bacteriophage and the Type I Poliovirus. The maximum removal obtained using a sodium salt-clay-virus system was 99% for each of the 3 clays studied. When the clay concentration was increased, the required salt concentrations to achieve maximum removal increased correspondingly. Competition for the adsorption site by other organics was demonstrated. It was determined that naturally occurring river clays (Missouri River) showed response very similar to those of the pure clay minerals.

W69-00719

THE ION-EXCHANGE REACTIONS OF RADIONUCLIDES WITH SOILS AND EFFECTS OF ORGANIC COMPOUNDS,

Illinois Univ., Urbana.

Bong Taick Kwon.

Dep Civ Eng Rept, Oct 1966. 150 p, 45 fig, 14 tab, 43 ref, append.

Descriptors: Ions, *Ion exchange, *Soils, Montmorillonite, Illite, Clay minerals, Adsorption, Organic compounds, *Cation exchange, Radioactive wastes, Radioactive waste disposal, *Radioisotopes, Radioactivity, Organic matter.

The ion-exchange reactions of radionuclides with soil minerals and the effects of various water soluble organic compounds on the reactions were investigated. Theories were examined for predicting equilibrium distribution of radionuclides in soils. Results show the mass-action law describes ion-exchange equilibria except in systems involving hydrogen ions. Certain organic compounds are irreversibly adsorbed on soil particles which reduces effective exchange capacity and the selectivity of the exchange media.

W69-00726

WESTON DRILLING COMPANY V TUPPER (OIL LEAKAGE AND WATER POLLUTION).

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00805

NO 112, AN ACT TO AMEND 10 V S A SEC 951 RELATING TO THE DEPOSIT OF SAWMILL WASTE.

Laws of Vermont 1967, No 112. 1 p.

Descriptors: *Legislation, Local governments, *Vermont, Water pollution, *Sawdust, Saw mills, *Wood wastes, Water pollution sources, Slabs, Lakes.

It is unlawful in Vermont to deposit edgings, slabs, sawdust, shavings or any other sawmill refuse in the waters of any stream, pond, reservoir, or lake or on the shore in such a manner as to be subject to being washed in the main body of water under normal high water conditions. A person who violates this statute may be fined a maximum of \$100. (R. H. Watson-Fla)

W69-00899

EFFECTS OF SOLUBLE ORGANICS ON FLOW THROUGH THIN CRACKS OF BASALTIC LAVA,

Hawaii Univ., Manoa.

Kenneth Ishizaki, Nathan C. Burbank, Jr., and

Stephen Lau.

Tech Rep 16, Water Resour Res Center, Aug 1967. 56 p, 38 fig, 9 tab, 42 ref, 2 append. OWRR Project A-001-Hi.

Descriptors: Percolation, Ground water, *Permeability, Porosity, Closed conduit flow, *Ground water movement, Capillary flow, *Lava, Basalts, Water pollution sources, Microorganisms, Ferrobacillus, Flow resistance, Retention, Hawaii. Identifiers: Hagan-Poiseuille flow, Clogging.

Most of Oahu's domestic water supply is from ground water occurring in permeable materials of volcanic rock. Movement of ground water is intrinsically through thin cracks in basaltic lavas. This project studied passage of an organic-rich liquid through cracks in basalt. Permeability of blue rock portions of a basalt was determined as 2.6 by 10 to the minus 4 power gal/day/sq ft of water, classing the rock as impervious. A range of 7.7 to 10.4% in porosity values was obtained from the blue rock portions; the clinker portion yielded a value of 50%. The greatest retardation in flow of non-biodegradable liquids through thin cracks occurred in the initial hours followed by a systematic reduction of flow to 7/8 to 1/100 of the initial flow rate. Flow of organic-rich liquids through such cracks, similar to nonbiodegradable liquids, exhibits a decrease in flow initially and continues this trend for as long as 220 hr. Terminal flow velocity of tap water is much greater than that of sewage which appears to proceed to a no-flow condition. The clogging phenomenon was dependent upon microbial activity and food supply in sewage. The products are primarily polysaccharides and slimes along with ferrous sulfide, commonly found in septic sewage in contact with soil or rock.

W69-00979

WATER QUALITY AS AFFECTED BY A WYOMING MOUNTAIN BOG,

Forest Service, Rocky Mountain Forest and Range Exper Station, Laramie, Wyo.

David L. Sturges.

Water Resources Res, Vol 3, No 4, pp 1085-1089, 1967. 5 p, 1 fig, 3 tab, 7 ref.

Descriptors: *Water quality, *Bogs, *Peat, Wyoming, Iron, Coliforms, Solutes, Silica.

Waters collected July through Oct 1965 at a Wyoming mountain bog were analyzed for potability and seasonal changes in calcium, magnesium, potassium, iron, and silica. Four locations were sampled: effluent stream, fissure locations in the bog, peat locations in the bog, and groundwater. The color and turbidity of peat water greatly exceeded that at other locations and the maximum levels established by the U S Public Health Service for drinking water. The dissolved mineral content of all waters was very low, and the waters were of excellent chemical quality. All waters contained coliform organisms, probably of a nonfecal origin in peat and fissure water. The concentration of minerals in peat water remained constant through the sampling period. Mineral concentrations in groundwater increased in Sept, when the water table was at a seasonal minimum, but decreased in Oct following water table recharge. Silica levels were higher than other ions at all locations; the highest levels were in peat water. (Author)

W69-01043

SURFACE CHLORIDE DISTRIBUTION IN MAINE LAKES,

Maine Dept. of Inland Fish and Game, Dry Mills Hatchery, Gray.

For primary bibliographic entry see Field 02H.

For abstract, see .

W69-01051

EQUILIBRIUM SURFACE WATER TEMPERATURES,

Colorado State Univ., Fort Collins.

For primary bibliographic entry see Field 02H.

For abstract, see .

W69-01058

THE QUALITY OF CONNECTICUT'S SURFACE WATERS,

U S Geological Survey, Hartford, Conn.

Chester E. Thomas, Jr.

Conn Univ Inst of Water Resources Rep 6, 11 p, July 1968. 1 fig.

Descriptors: *Water quality, *Surface waters, *Connecticut, Water pollution.

Effects of Pollution—Group 5C

Identifiers: Connecticut River, Thames River (Connecticut), Housatonic River (Connecticut).

Information on the quality of water in Connecticut streams is summarized in a lecture presented at the University of Connecticut on October 18, 1967. The chemical quality of most surface waters in the State is good. The dissolved-solids concentration generally ranges from less than 100 to about 200 ppm during low streamflow periods. Waters draining areas underlain by noncarbonate crystalline rocks or from the glacial materials derived from them are soft and low in dissolved solids. The higher dissolved-solids concentrations and harder waters occur in the western area of carbonate rocks and in the central lowland area where sedimentary rocks are dominant or where large quantities of industrial wastes are discharged to the streams. Excessive iron concentrations occur in streams at scattered locations throughout the State. Some stream water is polluted and has a high bacterial count or low dissolved oxygen content, making it unsuitable for domestic or recreation use. Pollution is most serious in the Connecticut, Housatonic, and Thames rivers. (Knapp-USGS) W69-01060

MIGRATION OF POLLUTANTS IN A GLACIAL OUTWASH ENVIRONMENT,
Washington State Univ., Pullman.
James W. Crosby, III, Donald L. Johnstone,
Charles H. Drake, and Robert L. Fenton.
Water Resources Research, Vol 4, No 5, pp 1095-
1114, October 1968. 17 fig, 1 tab, 17 ref.

Descriptors: *Pollutants, Groundwater, *Infiltration, Coliforms, Enteric bacteria, Nitrates, Chlorides, *Capillary conductivity, Soil moisture. Identifiers: Drain fields, *Test holes, Annual precipitation, Leach bed, Spokane River Valley.

A test drilling program was conducted in a drain field area of the Spokane Valley, Washington to study the movement of pollutants in glacial outwash deposits when they are subjected to extreme pollutant loads. Contrary to what might be expected, very dry soils were found at depths beneath the drain field, and it is concluded that most of the waters are being dispersed laterally by capillary mechanisms. Much of the systemic water may ultimately be returned to the atmosphere by evapotranspiration. Moisture conditions in the drain field system strongly indicate that groundwater recharge through incident precipitation in this part of the Valley would be highly improbable. Chemical pollutants are found to travel with moisture fronts, but fine materials are determined to be very effective in filtering bacteria within a relatively few feet of the leach bed. (Seneca-Rutgers)
W69-01076

A STUDY OF GROUND-WATER CONTAMINATION DUE TO OIL-FIELD BRINES IN MORROW AND DELAWARE COUNTIES, OHIO, WITH EMPHASIS ON DETECTION UTILIZING ELECTRICAL RESISTIVITY TECHNIQUES,
Ohio State Univ., Columbus.
Ronald S. Boster.
Water Resour Res, 1967. 191 p, 22 fig, 11 plate, 12 tab, 34 ref. OWRR Project A-004-Ohio.

Descriptors: *Groundwater, *Contamination, *Aquifers, *Wastes, Oil fields, *Brines, *Electrical resistivity, Saline water, Salinity Oil wastes, *Ohio, Instrumentation, Oil wells. Identifiers: *Ground-water pollution.

During a 5-yr period after an oil boom in Morrow County, Ohio, a serious contamination of ground-water aquifers occurred because of the lack of necessary conservation efforts. Millions of gallons of oilfield waters were disposed of through unlined bulldozed pits and truckloads of brine were dumped into Shaw and Whetstone Creeks, the 2 main effluent streams traversing the major production area. A study was initiated to determine the sources, severity, areal extent, and future move-

ment of polluted ground water. This study established the importance of the ion-exchange phenomena, which may greatly extend the time period required for natural clearing of an enclave. Resistivity studies were very effective in detection of contaminated ground waters and reinforced the above contention. Practical application of resistivity shows it can be a valuable investigative and diagnostic tool in ground-water pollution and has a decided advantage over chloride and conductivity analysis in that fewer observation wells are required.
W69-01119

ROLE OF CERTAIN STREAM-SEDIMENT COMPONENTS IN RADIION SORPTION,
U.S. Geological Survey.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-01176

5C. Effects of Pollution

WATER QUALITY ALTERATION THROUGH ACID AND HEAT POLLUTION IN A 1500 ACRE RESERVOIR,

Missouri Univ., Columbia.
Robert S. Campbell, James R. Whitley, and Edward R. Brezina.
Water Resour Res Center Proj Rep 1, Mar 1966. 33 p, 8 fig, 9 tab, 1 ref. OWRR Project A-004-Mo.

Descriptors: Water quality, *Water pollution, Turbidity, Heated water, Mine acids, Fly ash, Plankton, Aquatic life, Alkalinity, pH, Animals, *Fish-kill, Acidity, Hydrogen ion concentration, *Thermal pollution, Industrial wastes.

An investigation was made to evaluate the influence of several effluents on water quality, the biota, and the autotrophic aspects of community metabolism. Certain physical and chemical conditions vary throughout the reservoir in a pattern related to the site of hot water discharge. The most conspicuous environmental variant is water temperature, which ranges from 37 deg C at the steam plant discharge canal to 21 deg C at the western end of the lake. Dissolved oxygen range was 0.2 to 11.0 ppm, with the lower values from the deeper more stagnant water at the eastern and western ends of the lake. No evidence was found of alkaline drainage into the reservoir. At the time of reported fish kills, 1962-63, fly ash was piled adjacent to the reservoir. Fly ash is now stored in bins protected from the weather. Preliminary inspection of the plankton and bottom fauna suggests that the fauna is not rich.
W69-00735

INHERENT AND MAXIMUM MICROBIOLOGICAL ACTIVITY IN SMITH LAKE,
Alaska Univ., College.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-00744

JACKSON V ATLANTIC COAST LINE R R (RIPARIAN'S RECOVERY FOR POLLUTION).

317 F 2d 95 (4th Cir 1963).

Descriptors: Oil wastes, *Nuisance (Water law), Judicial decisions, *Remedies, Riparian land, Pollution (Stream), South Carolina, Railroads.
Identifiers: Damages (Exemplary), Negligence.

Oil spillage from a railroad yard was discharged into an adjacent ditch which in turn emptied into a stream. The waste was carried downstream and washed upon the land of a lower riparian owner resulting in appreciable damage. The owner sued the railroad on the theory of negligence and was awarded compensatory and punitive damages. The railroad appealed the award of punitive damages alleging plaintiff's failure to prove negligence. This

court affirmed the decision of the trial court, holding that the precipitation of oil upon the riparian owner's land was a continuing nuisance entitling him to recover damages without proof of negligence. Moreover, the continuation of the deposits despite repeated complaints by the owner was ample support for the award of exemplary damages. (Geraghty-Fla) W69-00835

THE ECOLOGICAL SIGNIFICANCE OF CELULOLYTIC BACTERIA IN QUABBIN RESERVOIR,

Clark Univ., Worcester, Mass.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-00976

FISH KILLS BY POLLUTION, 1966: SEVENTH ANNUAL REPORT.

Fed Water Pollut Contr Admin, Publ No CWA-7, 1967, 17 p, 11 tab, 4 rep.

Descriptors: *Fishkill, Water pollution effects, Fish conservation, Aquatic environment, Industrial wastes, Municipal wastes.

An estimated 9,115,000 fish were reported killed by identifiable pollution sources in 46 States during 1966. There were 95 other reports of fish kills in which pollution was suspected by the source could not be definitely determined. The total of reported kills is 2,500,000 less than in 1965 when 44 States reported kills of 11,784,000. The decline may have been actual or it may have been due to variations in reporting between the two years. The average number of kills was greater in 1966 than in 1965. The two worst cases of fish kills in 1966 - one million each - were caused by two of the most difficult problems facing pollution control experts - mine drainage and over-enrichment of water by municipal and other wastes. The annual fish kill census is gathered through the cooperation of individuals, State fish and game agencies, and water pollution groups.
W69-01123

MANIPULATION OF RESERVOIR WATER FOR IMPROVED QUALITY AND FISH POPULATION RESPONSE,
Wisconsin Conser Dep Water Resources Res Sect, Madison.

Russel C. Dunst.

Wis Conserv Dep Impoundment Stud Proj Annu Proj Rep 1966, 9 p, 1966. 88 tab. OWRR Project B-004-Wis.

Descriptors: *Data collections, *Impoundments, *Water quality, *Biological properties, *Stratification, Eutrophication, Temperature, Water circulation, Mixing, Fish, Wisconsin.

Water management techniques for impoundments are being studied to determine their effects on water quality and fish populations. The biological and environmental factors being studied include water temperature, dissolved oxygen concentration, nutrient content, water clarity, the composition and density of the bottom organism population, and several parameters of the fish population. The Cox Hollow Lake artificial circulation experiment was of primary interest during 1966. An Aero-Hydraulic System was installed on July 1, 1966; the impoundment, the inlet streams, and the discharge waters were studied before and after installation of the system. The severe stratification, present before circulation was operated, did not appear. Only a 6 deg difference between top and bottom water developed, and surface water temperature never exceeded 78 deg, which is estimated to be 7-8 deg below normal. Dissolved oxygen was present at the bottom for the first time. Algae blooms did not occur. Nutrient concentrations decreased. (Knapp-USGS) W69-01170

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

5D. Waste Treatment Processes

ANNOTATED BIBLIOGRAPHY - TEXTILE WASTES,

North Carolina Univ., Raleigh.

Harley Y. Jennings.

Water Resour Res Inst Rep 1966. 68 p, 297 ref. OWRR Project A-016-NC.

Descriptors: *Textiles, Water pollution sources, Waste treatment, Waste disposal, *Bibliographies, Water pollution, Pollution abatement, Oxidation, Waste water treatment, *Wastes, Waste identification, Industrial wastes, *Textile industry.
Identifiers: Waste management.

In May 1965, a feasibility study concerning the recovery of wastes from the desizing of fabrics as an approach to the alleviation of stream pollution by textile processing operations was initiated. It was the objective initially to examine the possibilities of recovering existing sizes, and examine the possibilities of using materials of known ease of recovery from aqueous solution as possible sizes. A search of the chemical literature concerning warp-size wastes, as well as other sources of pollution from textile mills was made. This annotated bibliography has been key-word coded and indexed to aid in retrieval of this information. The coding, whenever possible, was done according to the Thesaurus of Engineering Terms published by the Engineers Joint Council.
W69-00711

INFILTRATION AND PERCOLATION OF SEWAGE THROUGH OAHU SOILS IN CESSPOOL LYSIMETERS,

Hawaii Univ., Honolulu.

Melvin K. Koizumi, Nathan C. Burbank, and L. Stephen Lau.

Tech Rep 2, Aug 1966. 49 p, 18 fig, 6 tab, 25 ref, 4 append. OWRR Project A-001-Hi.

Descriptors: *Infiltration, *Percolation, *Sewage, Sewage disposal, pH, Sewage treatment, Soils, Lysimeters, Oxidation, Flow nets, Laboratory tests, Soil physical properties, Permeability, *Cesspools.
Identifiers: Oahu, Hawaii.

This study investigated conditions contributing to cesspool failure and followed selected parameters to measure the degree of treatment afforded sewage in cesspool disposal. This laboratory study utilized bench scale soil lysimeters and 2 basic soil types: the Wahiawa Low Humic Latosol and the Lolekaa Humic Latosol. A 99% reduction of the infiltration rate was evidenced by the Wahiawa soil over the experiment-period of 30 to 40 days. Both sewage-fed lysimeters containing the Low Humic Latosol developed a panlike layer of soil fines approximately 3 cm below the bottom of the cesspools, preventing the penetration of suspended solids after 7 days. The Lolekaa soil did not show such changes. Flow nets plotted from pressure readings of the Wahiawa Low Humic Latosol showed that clogging occurred in the 8 to 10-cm zone of the side wall and the soil base of the lysimeter containing this soil. Flow through the lysimeter was governed by infiltration, rather than percolation. The results of this experiment indicate that unless further degradation of the effluent is effected by the soil mass, incomplete degradation of the sewage makes it a definite hazard to groundwater sources. This study presents soil-effluent interaction at a 1-ft depth.
W69-00714

PRELIMINARY DESIGN AND SIMULATION OF CONVENTIONAL WASTEWATER RENOVATION SYSTEMS USING THE DIGITAL COMPUTER,

Federal Water Pollution Control Administration, Cincinnati, Ohio.

For primary bibliographic entry see Field 06C.

For abstract, see .

W69-00926

WATER SUPPLY AND POLLUTION CONTROL ASPECTS OF URBANIZATION,

Duke University, Department of Civil Engineering.

For primary bibliographic entry see Field 06B.

For abstract, see .

W69-00963

ELECTRODIALYSIS IN ADVANCED WASTE TREATMENT.

Cincinnati Water Research Laboratory, Robert A. Taft Sanitary Engineering Center, Ohio.

J. Douglas Smith, and John L. Eisenmann.

Fed Water Pollut Contr Admin, Publ WP-20-AWTR-18, Feb 1967. 219 p, 32 fig, 42 tab, 3 chart, 19 ref, 5 append.

Descriptors: *Tertiary treatment, *Electrodialysis, Demineralization, Economics, Membrane.
Identifiers: Wastewater renovation, Deionization.

A bench-scale experimental study was made to determine the practicality of partially demineralizing municipal waste water by electrodialysis. Using filtration alone and filtration followed by carbon adsorption as pretreatments, long term runs were made with a municipal secondary effluent to determine scaling and fouling effects of the water upon the electrodialysis membranes. During these runs a study was made to determine how high a ratio of product rate to concentrate rate could be obtained without forming scale on the membranes. Some fouling of anion membranes occurred with filtration and carbon adsorption pretreatment; without carbon adsorption, fouling was much worse. Scale formation was not a problem at product to concentrate ratios less than ten. At times much higher ratios were obtained without difficulty. The results of these runs indicated that the total operating cost for a 10-mgd electrodialysis treatment plant might be less than 10 cents per 1,000 gal. Information is presented on the relative selectivity of the membranes for the common ions in waste water. Included are data on the long term runs in which actual waste water was used, and some data on laboratory prepared solutions.
W69-01127

SUMMARY REPORT ADVANCED WASTE TREATMENT PROGRAM, JULY 1964-JULY 1967.

Fed Water Pollut Contr Admin, Cincinnati, Ohio.
Robert A. Taft.

Fed Water Pollut Contr, Res Ser Publication WP-20-AWTR-19, 96 p, 1968. 36 fig, 17 tab, 24 refs.

Descriptors: *Wastewater treatment, *Tertiary treatment, *Activated carbon, *Electrodialysis, *Ion exchange, *Reverse osmosis, Ultimate disposal, Cost analysis, Economic feasibility, Technical feasibility, Research and development.
Identifiers: Clarification, Advanced waste treatment, Nutrient removal.

Results of waste-treatment studies from 1964-67 are summarized. The treatment methods studied include solids removal, organic removal, inorganic removal nutrient removal, and ultimate disposal. Lime clarification, which removes suspended solids and dissolved phosphates, is also used in potable water supply systems and is economically favorable. Alum clarification should be successful at a cost of 8 cents per 1,000 gals. Activated, granular, and powdered carbon treatment should cost 8-12 cents per 1,000 gals if the carbon can be reactivated. Electrodialysis should cost 16 cents per 1,000 gal if fouling of membranes is eliminated by pretreatment of influent. Ion exchange and reverse osmosis should be competitive with electrodialysis. Nitrogen removal is a difficult problem, for which air-stripping of ammonia appears feasible and should not cost over 2 cents per 1,000 gals. Highly nitrified activated carbon or liquid effluent shows promise for ultimate nitrate removal. Knapp-USGS)
W69-01169

SE. Ultimate Disposal of Wastes

DISPOSITION AND CONTROL OF URANIUM MILL TAILINGS PILES IN THE COLORADO RIVER BASIN.

Federal Water Pollution Control Administration, Denver, Colo.

Fed Water Pollut Contr Admin Rep, Mar 1966. 36 p, 3 tab, 38 photo, 18 ref.

Descriptors: *Ultimate disposal, *Colorado River Basin, Waste dumps, Waste disposal, Mine wastes, Bibliographies, *Radioactive waste disposal, Water pollution.
Identifiers: *Uranium mill tailings.

This report on the disposal and control of uranium mill tailings piles in the Colorado River Basin reflects the concern of the Federal Water Pollution Control Administration with all aspects of the various radiochemical waste sources which have a potential for pollution of Colorado River Basin waters. The purpose of this report is to evaluate the radioactivity content of uranium mill tailings piles in the Colorado River Basin, to evaluate their radioactivity water pollution potential insofar as this is possible, and on a case by case basis, to indicate feasible and desirable remedial measures for controlling and limiting the spread of radioactivity from the piles.
W69-01122

5F. Water Treatment and Quality Alteration

INFLUENCE OF TURBULENCE ON SURFACE REAERATION,

Illinois Univ., Urbana.

E. R. Holley, and K. K. Klintworth.

Water Resour Center Rept, Sept 1966. 42 p, 9 fig, 1 tab, 11 ref. OWRR Project A-001-III.

Descriptors: *Turbulence, *Reaeration, Flow characteristics, Analysis, *Oxygenation, Temperature, Time, Diffusion, Anemometers, Calibrations, Instrumentation, Heat transfer, Experimental data, *Water purification, Water treatment, Water pollution control, Water quality control, Hot film anemometers.

Some numerical methods are described for determining vertical diffusion coefficients as a function of vertical coordinate in a turbulence vessel where there are no net velocities. It is planned to use this turbulence vessel and these numerical methods to study in detail the mechanics of diffusion of a substance (analogous to oxygen) which is absorbed at the free surface. A hot-film anemometer is to be used to make direct measurement of turbulence parameters affecting the diffusion process. The anemometer has been calibrated in water which was in solid body rotation. Some of the difficulties experienced with the hot-film sensor and corrective measures used are discussed. Preliminary diffusion tests have been made in the turbulence vessel where turbulence is generated by vertically oscillating screens made of expanded metal. Some values of the vertical diffusion coefficient have been calculated from the data for 2 of these preliminary runs. Plans call for more detailed diffusion studies and for making direct turbulence measurements in studying surface reaeration.
W69-00728

DRINKING WATER ANALYSIS PROGRAM, 1961-1966,

National Center for Urban and Industrial Health and National Center for Radiological Health, Washington, D. C.

Radiol Health Data and Rep, Vol 9, No 8, pp 442-448, Aug 1968. 2 tab, 6 ref.

Water Quality Control—Group 5G

Descriptors: *Data collections, *Radioactivity, *Potable water, *Water quality, Radiochemical analysis.

Identifiers: Drinking water standards.

Radioactivity concentrations of public drinking water supplies of about 800 communities in the U.S. are tabulated and standards are briefly outlined. The analyses were of samples collected between 1961 and 1966. They include DR-90, dissolved alpha radioactivity, suspended alpha radioactivity, dissolved beta radioactivity, and suspended beta radioactivity. The drinking water standards for radionuclides are conservative in their requirements. The standards provide for the approval of water supplies, based on their radionuclide content, when the water does not contain more than 3 pCi/liter of radium-226 or 10 pCi/liter of strontium-90. In the absence of strontium-90 (much less than 10 pCi/liter), and in the absence of alpha emitters (much less than 3 pCi/liter), the water supply is acceptable when the gross beta concentration does not exceed 1,000 pCi/liter. However, a water supply may be approved when the limits prescribed above are exceeded if it can be demonstrated by surveillance that the total intake of radioactivity from all sources is within the guidance recommended by the Federal Radiation Council for control action. When mixtures of radionuclides are present, the relative contribution of each radionuclide to the total intake of the individual should be considered when evaluating the exposure. (Knapp-USGS)

W69-00914

REMOVAL OF COLOR FROM SOUTH KOHALA WATER: HAWAII,

Hawaii Univ., Manoa.

Nathan C. Burbank, Jr., Po Lau Chan, and

Reginald H. F. Yound.

Tech Rep 14, Water Resour Res Inst, Res Proj Tech Completion Rep, Oct 1967. 30 p, 4 fig, 10 tab, 25 ref. OWRR Project A-013-Hi.

Descriptors: Water quality control, *Water purification, Coagulation, Zeta potential, Plant pigments, Water pollution effects, Chemical precipitation, Surface waters, Humic acids, Water treatment, Filtration, *Color, Physical properties, *Water quality, Colloids, Refractivity, Ion exchange.

Identifiers: Peptization.

The waters of the streams in the South Kohala district, on the island of Hawaii, have long been noted for extremely high color and a distinct peaty taste. Early attempts at treatment revealed that color bodies occurring in the water were refractive in nature and difficult to remove. At the end of 1 yr of research into the problem of removal of color from water, it has been found that color bodies are predominantly organic and characteristic of humic and tannic acids of vegetable origin. Color of the water has varied from a maximum value of 320 units to a minimum value of 22 units, the average is 80 units. Zeta potential of the color colloid complex has varied from 36 mv to 18.5 mv. Coagulation and removal of the color can be achieved using alum or ferric sulfate. Alum with an average dosage of 25 mg/l can reduce color level from 140 to as low as 10 mg/l while ferric sulfate at an average dosage of 20 mg/l can reduce color level of water to as low as 5 color units over a wide range of pH values (6.0 to 8.5). Such color reduction permits water to meet the Public Health Service standards for interstate carriers. The use of coagulant aids holds great promise for successful color removals at lower coagulant dosage.

W69-00983

THE FORMALDOXIME DETERMINATION OF MANGANESE,

Mine E. Enginun, and Robert S. Ingols.

Pap, Ga Acad Sci Conf, Statesboro, Ga, Apr 1966. 5 p, 3 fig, 2 ref. OWRR Project A-0050Ga.

Descriptors: Potable water, *Colorimetry, Chemical analysis, *Water treatment, Bacteria, Bactericides, Biological properties, *Manganese.

Identifiers: Reproducibility, Formaldoxime procedure.

This paper reports on studies with the formaldoxime procedure for determining manganese. For research only pure samples of manganese oxide have been in contact with the bacterial culture medium so that no interference from iron has been encountered but an evaluation has been made on effects of cyanide in manganese color density. For very small quantities of manganese the formaldoxime procedure of Sidoti may be modified to give good reproducibility by eliminating cyanide (when there is no iron present in the samples tested) and gum Ghatti if the absorbance is measured with half an hour. One drop of 5% freshly prepared peptone solution is recommended when more time is needed before optical density readings are taken or when cyanide is used to reduce iron interference.

W69-00987

FLOOD HAZARD PERCEPTION IN THE PAULINS KILL VALLEY, WARREN COUNTY, NEW JERSEY,

Rutgers-The State Univ., Newark, N.J., Geography Dept.

Jacquelyn L. Beyer.

NJ Water Resour Res Inst, Res Proj Tech Completion Rep, Oct 1967. 30 p, 4 fig, 10 tab, 25 ref. OWRR Project B-007-NJ.

Descriptors: *Attitudes, *Behavior, *Channel improvement, Control, *Decision making, *Delaware River, Federal Government, Flood control, Flood damage, *Flood plain insurance, *Flood plains, Flood protection, *Flood plain zoning, *Flood-proofing, *Floods, *Floodways, *New Jersey, Planning, Regulation, Social aspects, Urbanization, Local governments.

The purpose of the project was to examine assessment of flood hazard by occupiers of a flood plain in a small town on a tributary of the Delaware River. The basis for the study was the assumption that the technical assessment of the hazard would differ considerably from the users' perception and that the difference can be clarified by systematic investigation through interviews and questionnaires. In addition to questionnaires, field work for mapping and consultation with technical experts was carried out. Quality of the data obtained was satisfactory and meaningful conclusions with respect to general land-use planning problems offered. The article prepared for publication and based on this research should be helpful in providing some guidelines for individual and public decision making. This is especially so as the pace of urbanization increases in the region in which the study town is located.

W69-00991

5G. Water Quality Control

BEHAVIOR OF SELECTED PESTICIDES WITH PERCOLATING WATER IN OAHU SOILS,

Hawaii Univ., Honolulu.

Marshall A. Eto, Nathan C. Burbank, Jr., and

Howard W. Klemmer.

Tech Rep No 9, Aug 1967. 35 p, 16 ref, 6 tab, 41 ref. OWRR Project A-001-Hi.

Descriptors: *Pesticides, *Percolation, Pesticide kinetics, *Pesticide removal, Adsorption, Waste assimilative capacity, Organic pesticide, Infiltration, Ion transport, Path of pollutants, Lysimeters, Soil contamination effects, Clay loam, *DDT, Absorption, Volatility, Leaching, Organic matter, Organic wastes.

Identifiers: *Lindane.

This study investigated the ability of 2 Oahu soils, Wahiawa and Lahaina, to prevent chlorinated hydrocarbon pesticides, DDT and Lindane, in acetone solutions from percolating through soils. Wahiawa and Lahaina soils were effective in withholding DDT under saturated and intermittent flow conditions. Breakthrough of Lindane was

noted in Wahiawa and Lahaina soil under saturated flow and under intermittent flow conditions in Wahiawa soil only. Breakthrough concentrations were generally in the order of 0.3 ppm or lower. Breakthrough of Lindane and concentrations in the percolant were in direct proportion to soil volume. Column analysis showed that, in most cases, Lahaina soil held both pesticides in the upper 3 in. while Wahiawa soil held only DDT in the same region. Lindane was evenly distributed through the Wahiawa columns with a slightly greater amount held at the surface. Five Oahu soils tested to determine their ability to sorb pesticides from water-acetone solutions effectively removed pesticides in solute concentrations up to 100 ppm. DDT and Lindane were removed in the order of 90 to 100% by swirling the soils in the pesticide solutions. No desorption occurred with water, but both pesticides were desorbed with benzene.

W69-00713

PREDICTION OF BEGINNING AND DURATION OF ICE COVER,

Colorado State Univ., Fort Collins.

For primary bibliographic entry see Field 02C.

For abstract, see .

W69-00715

DECONTAMINATION OF RADIOACTIVELY CONTAMINATED WATER BY SLURRYING WITH YZAOO AND ZILPHA CLAYS,

Mississippi State Univ., State College.

William A. Goldsmith.

Dep Civ Eng Pap, Jan 1966. 74 p, 16 fig, 13 tab, 51 ref. OWRR Project A-004-Miss.

Descriptors: *Radioactive waste disposal, Nuclear wastes, *Radioactive wastes, Radioactivity, Radioisotopes, *Adsorption, *Clays, Colloids, Cation exchange, Montmorillonite, Kaolinite.

Identifiers: Double layer.

The benefits derived from the advancing use of nuclear technology have been accompanied by problems which have never been encountered before. One main problem to nuclear industry is waste disposal. A review of the available literature reveals that some natural clays possess the ability to adsorb radioisotopes. Chemical and mineralogical properties of Yazoo and Zilpha clays suggest they might be useful as adsorbers of radioisotopes. This investigation was made to determine whether Yazoo and Zilpha clays are useful adsorbers of 3 radioisotopes: cobalt 60, strontium 90, and cesium 137. This was accomplished by slurring a mixture of radioisotopes and tap water with varying dosages of Yazoo and Zilpha clays. Results obtained suggest that Yazoo clay is an effective adsorber of each radioisotope tested. No generalization can be drawn from results obtained concerning effectiveness of each clay for all radioisotopes, therefore, these results should be used as the basis for further investigation.

W69-00727

THE LAW OF WATER POLLUTION CONTROL,

Mississippi State Univ., State College.

P. H. Williams, L. L. McDougal, and William M. Champion.

Water Resour Res Inst Tech Rep, 1967. 18 p. OWRR Project A-014-Miss.

Descriptors: *Legal aspects, Federal government, Political aspects, State governments, State jurisdiction, Water quality control, Mississippi, Compatibility, Legislation, *Pollution abatement, *Water pollution control.

Identifiers: Water Quality Act, 1965.

The objectives of this study were to assess the present legal prescriptions relating to water pollution in Mississippi, compare these prescriptions with the Federal standards, and prepare legislation and regulations necessary to harmonize the law of this State with such Federal standards. The

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research under this project pursued a comprehensive examination of the problems relating to water pollution and governmental efforts to control such pollution. In analyzing the problems presented, the study first considered broad questions involving desirability of state versus Federal control of water quality. Study then was directed to requirements of Federal statute and guidelines, the Mississippi pollution control scheme prior to enactment of the Federal Act, and the new Mississippi water quality control law. The study then considered the Mississippi Air and Water Pollution Control Act to determine its compliance with Federal requirements, and concluded with desirable recommendations and alternatives.

W69-00733

POLLUTION OF WATERS.

Fla Stat 387 (1967).

Descriptors: Florida, *Legislation, *Underground streams, *Water pollution, Lakes, Rivers, Ditches, Streams, Cities, Septic tanks, Sewage disposal permits, *Surface-groundwater relationships, Surface waters, Drainage effects, Drainage water.

This chapter of the Florida Statutes is primarily concerned with the pollution by sewage of the underground waters of the state. It also covers pollution of lakes, rivers, streams, and ditches. It further requires that where septic tanks are used that they conform to FHA requirements. The statute provides that violations shall generally be punished as misdemeanors, although there are variations in fines according to the section violated. The State Board of Health is responsible for supervision of this act. In addition to fine and imprisonment, injunctions are available where appropriate. (Crabtree-Fla)

W69-00763

PRESIDENT'S MESSAGE ON CONSERVATION AND WATER MANAGEMENT,

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00770

GARBAGE DISPOSAL AND WASTE ALONG STREAMS.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00771

FEDERAL POLLUTION CONTROL,

H. W. Poston.

American Water Works Ass'n Jour, Vol 58, No 9, pp 1108-1112, Sept 1966. 5 p.

Descriptors: *Water pollution, Pollution abatement, *Federal project policy, Federal government, Sewage treatment, Water quality control, River basins, *River basin development, Research and development, Federal budgets.

The Federal Water Pollution Control Act as amended by the Water Quality Act of 1965 established a Federal Water Pollution Control Administration. This agency was transferred from the Dept of Health, Education and Welfare to the Dept of the Interior in 1966. The expanded Federal Water Pollution Control Program includes six main activities: (1) aid to communities for waste treatment -- the federal government can pay up to \$1,200,000 for a single project and \$4,800,000 for a multi-municipal project; (2) enforcement -- if pollution from one state endangers another, the Secretary of the Interior can take action to abate the pollution; (3) research -- the federal government is building twelve new laboratories for studies in renovating waste water; (4) river basin programs - there are projects in ten major basins at present with plans for programs in all this country's major basins. The government has set up water quality standards for water users. Standards are set by the

federal government only after states have failed to establish their own. Finally the federal government provides scientists and engineers to states and industries for technical assistance. New bills are being introduced, including a \$6 billion program for sewer works construction and a pollution control bill under a river basin approach. (Kahle-Fla) W69-00772

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, DEPARTMENT OF THE INTERIOR.

18 CFR Ch 5 Sec 601.0-601.25 (1968).

Descriptors: *United States, Legislation, *Grants, *Water pollution treatment, *Sewage treatment, Sewers, Public benefits, Navigable waters, Treaties, Public health, Wages, Projects, Water supply, Conservation, Regulation, Administration, Administrative agencies.

Identifiers: *Federal Water Pollution Control Act, FWPCA.

The Act establishes grants for states and interstate agencies for the prevention and control of water pollution. The requirements for and the methods of making the grants are provided. A plan must be submitted to the Commissioner in applying for a grant. The Act also provides: (1) the formula for determining payment amounts; (2) the factor's used by the Commissioner in determining the desirability of treatment works projects; and (3) the criteria for considering the propriety of federal aid. All applicants must insure certain described labor standards by providing for them in contracts for project work. Subpart C provides for grants to demonstration projects for the control of discharges from stormwater or combined sewer systems. The requirements and regulations for these grants are described. Subpart D provides for grants to qualifying research, training or demonstration projects. Grants for fellowships for research, of the causes, prevention and control of water pollution are established. The Secretary of the Interior may certify facilities under Section 48 (h) (12) of the Internal Revenue Code as being within the requirements for water pollution control under the listed standards. Public hearings are provided for. (Childs-Fla)

W69-00776

APPLICATION OF CITY OF JOHNSTOWN (SEWAGE DISPOSAL AND WATER POLLUTION).

12 App Div 2d 218, 209 NYS 2d 982-985 (1961).

Descriptors: Judicial decisions, *New York, *Water pollution, *Sewage disposal, Water pollution control, Streams, Sewage, Administrative agencies, Fresh water, Odor, Public health, Preferences (Water rights), Non-navigable waters, Cities, Municipal wastes, Administrative decisions.

The City of Johnstown sought review of an order of the Water Pollution Control Board requiring it to discontinue disposal of untreated sewage into a creek which had been classified to permit such use only if it did not cause a public nuisance. The court found that noxious odors emanating from the stream were caused by the city's sewage, and that this condition annoyed and endangered the comfort, repose, and health of a 'considerable number' of persons, thus constituting a public nuisance. The Board had power to classify the stream because 'waters of the state' included all fresh water in streams, public or private; thus the fact that the creek here was non-navigable and owned by private riparian owners had no effect on the Board's power to classify. The city's argument that the classification and order were an interference with a 'property right' was untenable, since such rights do not attach to the water itself, and are required to yield to public health and safety. The court confirmed the Board's order. (Smidish-Fla) W69-00783

AN ACT RELATING TO PROTECTING SOURCE OF PUBLIC WATER SUPPLY.

Maine Public Law Ch 341 (1967).

Descriptors: *Maine, Water supply, *Cities, *In-takes, Legislation, Water quality, Regulation, Utilities, Water pollution sources, Water pollution control, Industrial wastes, Sewage, Pollution abatement.

Section 2436 of the Maine Revised Statutes is amended. Any water utility or municipality is authorized to take reasonable methods to protect its public water supply. It may enter land within 1000 feet of any lake, pond, well, spring, river or stream, from which it draws its water supply. Any health inspector or officer may order the owner of any building on such land, which has a system of drainage or sewage flowing or seeping into the source of the water supply, to remedy the situation. The order is to be written and set a time limit for compliance. This act is in no way to limit any private or special acts giving water utilities or municipalities greater powers to protect their sources of public water supply. (R. F. Williams-Fla) W69-00792

AN ACT TO CREATE THE AIKEN COUNTY AIR AND WATER POLLUTION COMMISSION AND TO DEFINE ITS POWERS AND DUTIES.

South Carolina Laws 1967, No 221.

Descriptors: *South Carolina, Legislation, *Water quality, Water pollution control, Local governments, *Administrative agencies, Political aspects, Industrial wastes, Standards.

An eleven-member Aiken County Air and Water Pollution Commission is created. The commission is to maintain surveillance to insure a reasonable degree of purity of the county's water resources. It shall investigate the quality of water where necessary, keeping a particular watch for industrial pollution. The commission is to report and make recommendations to the county's legislative delegation. Cooperation among polluters to attempt to control pollution is encouraged. The commission is authorized to contract in connection with its duties, accept grants and gifts, and to investigate and hold hearings. This act is not to infringe on any duties of the Pollution Control Authority, and the commission's duties are intended to assist the county's legislative delegation in maintaining the health and welfare of the people of Aiken County. (R. F. Williams-Fla) W69-00794

EXEMPTION FROM TAXATION OF AIR AND WATER POLLUTION FACILITIES.

Georgia Laws 1967, No 456.

Descriptors: *Georgia, *Air pollution, *Water pollution, Pollution abatement, *Taxes, Treatment facilities, Legislation.

Identifiers: Georgia Water Quality Control Board.

All property used in or apart of any facility installed or constructed for the primary purpose of eliminating or reducing air or water pollution, has been exempted by the State of Georgia from all ad valorem property taxes. Provided, however, such facilities have been certified as necessary and adequate for such purposes by either the Georgia Water Quality Control Board and/or the State Board of Health. (Geraghty-Fla) W69-00824

UNITED ELECTRIC COAL COMPANIES V BROWN (INSUFFICIENT EVIDENCE OF POLLUTION DAMAGE).

354 S W 2d 502-504 (Ky 1962).

Descriptors: *Judicial decisions, *Kentucky, Soil contamination, Water pollution, *Strip mine wastes, Coal mine wastes, Water pollution sources, *Damages, Streams.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

The court of Appeals of Kentucky held that evidence was insufficient to establish that creek water, allegedly contaminated by defendant's strip mining operation, was injurious to plaintiff's farm land and whether such damage was permanent. Judgment for plaintiff was reversed with instructions to enter judgment for the defendant. Plaintiff offered no direct evidence that the water flowing in the stream contained chemical properties injurious to his land or crops or that injuries, if any, were of permanent nature. His case was built on circumstantial evidence which the court found insufficient. (MacMillan-Fla)
W69-00880

AUBELE V GALETOVICH (RIGHT OF RIPARIAN OWNER TO INCREASE FLOW AND POLLUTE WATER).

165 NE 2d 683-686 (Ct App Ohio 1960).

Descriptors: *Municipal wastes, Sewage effluents, Waste water, *Septic tanks, Reasonable use, Domestic wastes, Overflow, Water levels, Drainage, Surface drainage, Drainage water, Drainage effects, *Ohio, Judicial decisions.

Village residents through whose lands a natural watercourse ran, brought an action to enjoin developers and the village from casting surface waters and septic tank effluent into the watercourse above their land. The court, affirming a judgment for the defendants, held that lower riparian owners could not obtain an injunction against development of additional riparian lots merely because of the resulting increase in the flow of the watercourse. One may obtain the right to cast sewage upon the lands of another without his consent only by purchase. Plaintiffs in this case failed to establish their claims by that degree of proof necessary for an injunction. The testimony indicated that the water emitted no offensive odor and contained no foreign matter, bacteria or e-coli in greater amounts than many other such streams. (Headley-Fla)
W69-00885

CITY OF DERBY V WATER RESOURCES COMM'N (DISCHARGE OF UNTREATED SEWAGE PROHIBITED).

172 A 2d 907-911 (Conn Sup Ct Err 1961).

Descriptors: *Connecticut, Administrative decisions, Civil law, Community development, Judicial decisions, Local government, Social needs, Sanitary engineering, *Sewage treatment, Waste water treatment, Treatment facilities, Sewage, *Municipal wastes, Sewage disposal, *Water pollution.

Plaintiff, a municipal corporation, was discharging untreated sewage into two rivers in violation of state law. The State Water Commission ordered the plaintiff to submit to the commission and the state department of health detailed plans: (1) for a system to adequately treat and collect its sewage; (2) to put the project out for bids; and (3) to complete the construction of the system, all by certain dates. The plaintiff appealed from this order but it was affirmed, holding the plaintiff's claim that the order was unrealistic for financial reasons to be without merit. The court asserted that public health cannot be endangered because of a reluctance on the part of municipal authorities to face up to a city's problems and find available means for coping with them. (S. Scott-Fla)
W69-00893

VICKERS V CITY OF FITZGERALD (WATER POLLUTION).

117 SE 2d 316-320 (Ga 1960).

Descriptors: *Water pollution, *Sewage, Public rights, Damages, *Riparian rights, Riparian land, Water law, Legal aspects, Municipal wastes, *Georgia.
Identifiers: Public nuisance.

The plaintiff brought action for damages to his lakeside resort area caused by the city's dumping of sewerage into the lake. Plaintiff's petition was held to set forth a cause of action for the recovery of damages and for the granting of injunctive relief. A lower riparian owner is entitled to have water flow upon his land in its natural state free from adulteration. Since the nuisance complained of was a continuing one, and it continued to the date of the suit, the statute of limitations did not apply. (Horner-Fla)
W69-00894

AN ACT RELATING TO THE USE OF WATER FROM BIRCH LAKE AND THE SOUTH KAWISHIWI RIVER IN CONNECTION WITH MINING.

Minnesota Laws 1967, Ch 556. 2 p.

Descriptors: *Minnesota, Mining, *Mine drainage, Administrative agencies, Water quality control, Standards, *Water permits, Flooding, Non-consumptive use, State jurisdiction, Legislation, *Withdrawal.

Copper, copper-nickel mining companies are authorized to use water from Birch Lake and the South Kawishiwi River and to flood or affect state lands adjacent thereto. Permits from the commissioner of conservation are required for withdrawals. All waters withdrawn must be returned to the same drainage basin from which they were taken, in conformity with established water quality standards. Permits from the water pollution control commission are required for construction, operation and maintenance of disposal systems. Permits are also required for flooding of state lands. (R. F. Williams-Fla)
W69-00897

AN ACT RELATING TO WATER POLLUTION CONTROL: AMENDING MINNESOTA STATUTES 1965, SECTION 115.44, BY ADDING A SUBDIVISION.

Minnesota Acts Ch 203 (1967).

Descriptors: *Minnesota, *Legislation, Administrative agencies, Federal jurisdiction, Regulation, *Standards, Water quality, State jurisdiction, *Classification.

Minn Stat Sec 115.44 (1965) is amended to authorize the water pollution control commission to waive compliance with other requirements of this section with regard to classifying waters or adopting standards if it finds such to be necessary to comply with the Federal Water Pollution Control Act or any other federal law or regulation. It is also authorized to classify waters and to adopt criteria and standards to conform to federal law, notwithstanding other provisions of Minnesota law, compliance with other requirements of this section is directed where, and as soon as, possible. The commission is also authorized notwithstanding subdivision 4, to set effluent standards, regardless of whether the waters they enter are classified or unclassified. (R. F. Williams-Fla)
W69-00898

AN ACT TO AMEND 10 V S A SECS 902 AND 909 AND 24 V S A SEC 3611 AND TO REPEAL SEC 9 OF NO 139 OF THE ACTS OF 1965 RELATING TO POLLUTION CONTROL.

Laws of Vermont 1967, No 181. 2 p.

Descriptors: Financing, *Vermont, *Legislation, Administrative agencies, *Water pollution, *Sewage districts, Classification, Recreation, Water conservation, Water control, Water purification, Water quality, Water sports, Water treatment, Disinfection, Irrigation, Filtration.

Vermont classifies its water into four groups according to possible uses. Class A is suitable for public water supply with disinfection when neces-

sary. Its character is uniformly excellent. Class B is suitable for bathing and recreation, irrigation, and agricultural uses. It is a good fish habitat with aesthetic value. It is acceptable for public water supply with filtration and disinfection. Class C is suitable for recreational boating, irrigation of crops not used for consumption without cooking, as a habitat for wildlife, and such industrial uses as are consistent with other Class C uses. Class D is suitable for supporting aerobic aquatic life, for power, navigation, and certain industrial process needs consistent with other Class D uses. Pollution of water is prohibited in Vermont except with written authorization. The board may take action against any person who reduces a body of water from one classification to another. The duties of the sewage disposal commissioners are listed. They include the power to require any person to connect to the municipal sewage system to abate the pollution of waters. (R. H. Watson-Fla)
W69-00901

AN ACT TO AMEND 10 VSA SEC 1153 RELATING TO REPORTS OF WELL DRILLERS.

Laws of Vermont 1967, No 168, 1 p.

Descriptors: *Vermont, *Legislation, Administrative agencies, Water resources, *Water analysis, Chemical analysis, Laboratory tests, Wells, *Well regulations, Drilling.

Vermont requires all well drillers to submit to the water resources board within six months after the drilling, a report of the physical and chemical analysis of a sample of water from each well drilled. The analysis may be obtained from the state health laboratory, from private facilities with the consent of the board, or from the board itself on payment of a fee of \$5.00 for each analysis made. (R. H. Watson-Fla)
W69-00902

CH 254 - AN ACT RELATIVE TO THE PREVENTION OF POLLUTION FROM DREDGING, FILLING, MINING, OR OTHER CONSTRUCTION.

Laws of New Hampshire 1967, Ch 254, 1 p.

Descriptors: *Legislation, *New Hampshire, *Water pollution, Administrative agencies, Landfills, *Dredging, Excavation, Mining.

New Hampshire amended its statute on the prevention of pollution from dredging, filling, mining, or other construction. The amended statute makes any person proposing to dredge, excavate, place fill, mine or undertake construction in the surface waters of the state directly responsible for the submission of plans concerning such proposal to the commission at least 30 days prior to undertaking any such activity. The commission's written permission to conduct such operations is required. The commission has full authority to establish the terms and conditions under which the permit may be exercised. (R. H. Watson-Fla)
W69-00907

CH 145 - AN ACT PROVIDING FOR THE PROTECTION OF THE SURFACE WATERS OF THE STATE BY PREVENTING THE DEPOSIT THEREIN OF RUBBISH AND WASTES.

Laws of New Hampshire 1967, Ch 145, 1 p.

Descriptors: *Legislation, *New Hampshire, Water pollution, Administrative agencies, *Surface waters, *Wastes, Ice, Banks, Domestic wastes.
Identifiers: Rubbish, Litter.

New Hampshire amended its general water pollution statute. The statute now makes it unlawful for any person to place any bottles, glass, crockery, cans, scrap metal, junk, paper, garbage, tires, old automobiles or parts, trees or similar litter in a surface water of the state or on the ice covering the surface water or the banks. An agent of the commission shall order immediate removal of the

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

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material by the violator. If the violator refuses the agent may contract to have the litter removed and the violator will be liable for the cost of the removal in an action of debt. Also any violator will be subject to a fine of not less than \$25 or more than \$100. (R. H. Watson-Fla)
W69-00908

ALTERNATIVE ECONOMIC RESPONSES TO THE ACID MINE DRAINAGE PROBLEMS IN APPALACHIA,

Ohio State Univ., Columbus.

Richard A. Tybout.

Water Resources Center, Feb 1968. 42 p, 3 tab, 17 ref. OWRR Project A-005-Ohio.

Descriptors: *Mine drainage, *Acid mine water, Benefit-cost ratios, Mine acids, Benefits, Costs, Indirect benefits, Coal mines, Waste disposal, Strip mine wastes, Water pollution, Water pollution sources, *Pollution abatement, *Coal mine wastes, Mathematical models, Aesthetics.
Identifiers: Appalachia, Beautification.

The study consists of a cost-benefit analysis of the pollution abatement problem from acid mine drainage. Empirical information is based primarily on experiences in Pennsylvania, the only public program for abatement in effect at the present time. Costs are found in 3 parts: (1) costs of treatment; (2) costs of sealing; and (3) secondary costs. First, employment, wage, price, and production series were constructed county-by-county to isolate effects of treatment costs on employment. Second, for generalizing costs to the states, predicting mine drainage was analyzed on the basis of (1) volume of drainage per ton of coal mined, by county, with subcases for deep and strip mining with corrections for seam thickness and hydrologic conditions; (2) quality of drainage as affected by surrounding geological strata. Benefits are found for (1) municipal water treatment; (2) industrial water usage, and (3) recreation. Aesthetic improvements are also benefits, but a method of measuring is not currently available; therefore, the level of aesthetic benefits required to offset costs was determined by difference. Secondary benefits of community impact of tourist expenditures are included. Conceptual limitations to the use of secondary costs and benefits are noted.

W69-00972

TO INVESTIGATE THE DISPOSAL OF AGRICULTURAL PRODUCT WASTES THROUGH THE SOIL,

Maine Univ., Orono.

R. V. Rourke.

Water Resour Center Term Rep R1084-3, 1967. 8 p, 2 tab, 8 ref, append. OWRR Project A-002-Me.

Descriptors: *Particle size, *Filtration, *Biochemical, *Filters, Oxygen demand, Waste water treatment, *Pollution abatement, Topsoil, Organic waste, Porous media, *Soils.

A trial was initiated to determine the ability of various soil textures to filter the waste water effluent of a potato processing plant. The filtering efficiency was based upon the biochemical oxygen demand of the water before and after passing through a 6 inch soil layer. The trial period was for 7 weeks and consisted of a weekly irrigation of 4000 ml. of waste water to 4 square feet of soil surface. As judged by reduction of the biochemical oxygen demand the filtering efficiency of loamy fine sand was greater than that of sandy loam. Silt loam had the lowest filtering efficiency. (Author)

W69-00990

TERPENES FROM SULFATE PULP MILL WASTE LIQUOR: THE PRODUCTION OF CIS- AND TRANS-CARONIC ACIDS FROM DELTA-3-CARENE,

Montana State Univ., Bozeman, Chem Eng Dept.

James H. Jarrett.

Report of Accomplishment, Dec 1967. 85 p, 28 fig, 2 tab, 22 ref, append. HEW-PHS Grant No. WP-00510-05.

Descriptors: *Pulp wastes, *Pulp and paper industry, Byproducts, Industrial production, Oxidation, Oxidation-reduction potential, Sulfates.

Identifiers: Terpenes, Turpentine, Dibasic acid.

The sole known source of delta-3-carene, a bicyclic terpene, in the United States and Canada is in the by-product turpentine produced by 5 western Kraft pulp mills. The present potential supply of delta-3-carene is 1000 gallons per day. Two cyclopropane ring-containing dibasic acids (*cis*- and *trans*-caronic acids) were recovered in 99 percent purity from the mixture of oxidation products obtained by the potassium permanganate oxidation of delta-3-carene in acetone. The yield of *cis*-caronic acid was 6.5 percent and the yield of *trans*-caronic acid was 0.5 percent. The identification of *cis*- and *trans*-caronic acid was based on commercial analysis for carbon, hydrogen and oxygen, and on infrared and nuclear magnetic resonance spectroscopy. The spectra are included in this thesis.

W69-00992

THE EFFECT OF SELECTED HERBICIDES UPON THE GROWTH OF PLANKTONIC FRESH WATER ALGAE AND THEIR PERSISTENCE IN SURFACE WATERS,

Louisiana Polytechnic Institute, Ruston, Botany and Bacteriology Dept.

Otto Wasner, Jr.

Louisiana Water Resour Res Inst, Louisiana State Univ, Baton Rouge, May 1967. 19 p, 11 fig, 5 ref. OWRR Project A-003-La.

Descriptors: *2-4 D, *Herbicides, *Phytoplankton, *Phytotoxicity, Algal poisoning, Scenedesmus, Chlorella, *Euglena, Algal control, Bactericides, Growth rates.

The purposes of the investigation were to determine effect of selected herbicides upon the rate of growth of certain fresh water planktonic algae; to determine effect of selected herbicides upon the physiology of these algae; and to determine morphological changes in algae exposed to herbicide presence. Due to limitations imposed by time, certain restrictions in the investigational procedures were necessary. A signal species of fresh water algae was utilized in the complete investigation, although 2 other species were examined in the morphological studies. A single herbicide was used in all phases of the study. Finally, the physiological study was confined to the effect of herbicide presence on rate of respiration in algal cells.

W69-00994

SUB-SURFACE IRRIGATION OF TURF AREAS, NOZZLE DESIGN AND SPACING,

Massachusetts Univ., Amherst.

Lester F. Whitney.

Project Completion Report, Jan 1968. 11 p, 5 ref. OWRR Project A-015-Mass.

Descriptors: *Subsurface irrigation, *Distribution systems, Water pipes, Irrigation, *Nozzles, Orifices, Soil moisture, Moisture content, Orifice flow, Plastic pipes, Turf, Spatial distribution, Profiles, Water utilization.

Subsurface irrigation of crops and turf areas can permit up to a 40% reduction in water usage, provide automatic irrigation, and permit introduction of liquid chemicals into the root zone. The main deterrent to widespread adoption of this method has been the absence of an orifice which resists internal and external clogging; one which approaches the longevity of the polyethylene plastic pipe lateral system. Results from this work have culminated with an injection-molded plastic insert nozzle which pierces the plastic pipe wall such that the inlet to a sized orifice is at the point of maximum velocity within the pipe. A labyrinthian pro-

tection for the orifice prevents external clogging. All in-wall orifices have been found to be unequivocally nonuniform and short lived. Spacing of orifices have been related to soil profiles and soil types for which flow parameters have been established. The findings are significant in providing a designed orifice for subsurface irrigation with maximum protection against internal and external clogging leading to a longevity approaching that of the base pipe material.

W69-00996

WATER POLLUTION CONTROL IN SEMI-ARID AND ARID ZONES,

Hebrew Univ., Jerusalem, Israel.

Hillel I. Shuvat.

In affiliation with World Health Organization, Geneva. Water Research, Vol 1, No 4, pp 297-308, April 1967. 12 p.

Descriptors: *Water pollution control, *Arid lands, *Semiarid climates, Water conservation, *Water utilization, *Waste water disposal, Water quality, Water reuse, Domestic wastes, Groundwater recharge, Irrigation practices, Dry seasons, Public health, Sewage treatment, Sanitary engineering, Industrial wastes.

Limited water resources in semi-arid and arid zones caused special water pollution problems. Aspects of water utilization were discussed. It was suggested urban and industrial waste waters be utilized for direct irrigation, industrial purposes and recharging and replenishing the aquifer under arid zone conditions. Israel was presented as a case study in waste water utilization. Agricultural irrigation, both restricted and unlimited, were discussed as was water recharge. (Affleck-Ariz)
W69-01024

ALTERNATIVE METHODS OF IMPROVING STREAM QUALITY: AN ECONOMIC AND POLICY ANALYSIS,

Johns Hopkins Univ., Baltimore, Maryland

David F. Bramhall, and Edwin S. Mills.

Water Resources Research, Vol 2, No 3, pp 355-363, Third Quarter 1966. 4 fig, 2 tab, 9 ref.

Descriptors: *Water quality control, Economics, Waste disposal, Economic efficiency, Control, Low flow augmentation, Waste treatment, Costs, Governments, Water pollution, Taxes, Streamflow, Industries, Regulation.

Identifiers: *Public policy, Effluent fees.

Neither markets nor other institutional mechanisms exist which register the benefits and costs of alternative stream qualities or of alternative methods of achieving a given stream quality. It is therefore necessary to study such benefits and costs and to design special public policies to achieve desirable stream qualities in an economical way. The two most prominent methods of improving stream quality are waste treatment and low flow augmentation. Estimates are presented of the cost of achieving given stream qualities by various combinations of waste treatment and low flow augmentation. Data is taken from the author's study of future water supply and demand in Maryland, but the conclusions are thought to be applicable through the humid eastern part of the United States. The main conclusion is that low flow augmentation is a less economical method of improving stream quality than about 90% waste removal by secondary treatment, or its equivalent in industrial process changes at the point of waste generation. Alternative public policies for achieving improved stream qualities by economic methods are evaluated. A combination of effluent fees and enforcement is judged desirable. (Seneca-Rutgers)
W69-01068

WATER QUALITY MANAGEMENT AND THE TIME PROFILE OF BENEFITS AND COSTS, Water Resources Engineers, Walnut Creek, California.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

For primary bibliographic entry see Field 06B.
For abstract, see .
W69-01071

OPTIMAL TAXING OF WATER POLLUTION,
Chicago Univ., Illinois.
Charles Upton.
Water Resources Research, Vol 4, No 5, pp 865-875, October 1968. 11 p, 3 fig, 11 ref.

Descriptors: Marginal costs, *Water pollution, *Water management, Water quality, Efficiencies, Biochemical oxygen demand, Dissolved oxygen.
Identifiers: *Optimal taxes, *Second order conditions, Subsidy, *Low flow augmentation, Nonpecuniary externality.

This paper attempts to show that within the context of the model presented, optimal taxes on water pollution do exist. The condition for these taxes is to raise revenue sufficient to pay for the cost of low flow augmentation. The social cost of cleaner water is also calculated. The 'waste' load discharge method of taxation is then shown to be preferable to the 'increased permissible waste load method' when taxes do not cover augmentation costs. The difference between augmentation costs and taxes, the subsidy, is defined as a function of marginal and average costs of streamflow. If there are economies of scale ($MC < AC$), then the subsidy is negative; if there are diseconomies of scale, it is positive. Taxes will cover treatment costs if and only if the subsidy is greater than or equal to zero. The rest of the paper is a study of the effects of three schemes that were proposed in a study undertaken for the Ohio Department of Health. The three questions asked about each scheme were: is it equivalent to the optimal tax; under what special conditions is it equivalent to the optimal tax; under what conditions is it the best nonoptimal tax. (Seneca-Rutgers)
W69-01084

RECOVERABLE WARP SIZES - A FEASIBILITY STUDY,
North Carolina Univ., Raleigh.
Harley Y. Jennings, and Richard N. Berrier.
Water Resour Res Inst Proj Completion Rep, Oct 1965. 5 p. OWRR Project A-006-NC.

Descriptors: *Textiles, *Water pollution control, *Industrial wastes, Liquid wastes, Water pollution sources.

The objective of this study was to examine in a very limited degree the possibility of recovering and reusing textile sizes. It was concluded that textile sizes constitute a pollution problem. There is little indication that the industry will attack the problem until required to do so, and the School of Textiles at N. C. State University should develop a program aimed at reducing stream pollution by textile sizes through substitution, recovery, and reuse of size materials. (Howells-NoCarolina)
W69-01110

PERSISTENCY OF 2,4-DICHLOROPHENOX-YACETIC ACID AND ITS DERIVATIVES IN SURFACE WATERS WHEN USED TO CONTROL AQUATIC VEGETATION.
Southwestern Louisiana Univ, Lafayette.
William K. Averitt.
Louisiana Water Resour Res Inst, Sept 1967. 67 p, 33 fig, 7 ref, append. OWRR Project A-003-La.

Descriptors: *Herbicides, *2-4 D, Persistence, Aquatic plants, *Weed control, Alligatorweed, *Aquatic weeds, 2-4-T, *Hyacinth (Water), Pesticide residues.

The question of persistency and residues of various herbicides in surface waters, after being treated to control aquatic vegetation, is of prime importance in the maintenance of clean water. Laboratory and field test plots were sprayed with 2,4-D to control water hyacinth and alligatorweed. In some in-

stances the PGBEE of 2,4-D or PGBEE of 2,4,5-Trichlorophenoxypropionic acid was also used. Residue determinations of the herbicides were about 800 ppb at 1 day after spraying and diminished to almost zero in 4 months time. In another series of tests, various organic acids were used in conjunction with the herbicides mentioned. Residue levels were similar to those in the tests when the herbicide alone was employed. However, it was noticed that the use of the organic acid increased the chemical activity, and the herbicide was found to have a somewhat delayed residue appearance in the water.
W69-01112

ACTIVITY OF MICROORGANISMS IN ACID MINE WATER.

Ohio State Univ, Columbus.
Jon H. Tuttle, C. I. Randles, and P. R. Dugan.
Jour of Bacteriology, pp 1495-1503, May 1968. 9 p, 6 fig, 1 tab, 12 ref. OWRR Project A-002-Ohio.

Descriptors: Acidic water, Water quality, Acidity, pH, Mine wastes, Aerobic bacteria, Ecology, Chemical analysis, Iron bacteria, Bacteria, Anaerobic bacteria, Water pollution, *Microorganisms, *Acid mine water, Water sampling, Streams.

Comparison of microbial content of acid-contaminated and nonacid-contaminated streams from the same geographical area indicated that nonacid streams contained relatively low numbers of acid-tolerant heterotrophic microorganisms. The acid-tolerant aerobes survived when acid entered the stream and actually increased in number to about 2000/ml until the pH approached 3.0. The organisms then represented the heterotrophic aerobic microflora of the streams comprised of a mixture of mine drainage and nonacid water. A stream which was entirely acid drainage did not have a similar microflora. Most gram-positive aerobic and anaerobic bacteria died out very rapidly in acidic water, and they comprised a very small percentage of the microbial population of the streams examined. Iron- and sulfur-oxidizing autotrophic bacteria were present wherever mine water entered a stream system. The sulfur-oxidizing bacteria predominated over iron oxidizers. Ecological data from the field were verified by laboratory experiments designed to simulate stream conditions.
W69-01115

WILLAMETTE RIVER BASIN WATER QUALITY CONTROL AND MANAGEMENT.

Federal Water Pollution Control Administration, Portland, Oreg.

Fed Water Pollut Contr Admin Rep, Jan 1967. 91 p, 18 fig, 53 photo, 11 map, 37 tab.

Descriptors: *Water quality, Water management, *Water pollution, *Pollution abatement, Waste treatment, Flow control, Oregon, Water utilization, Pulp wastes, Wood wastes, Pulp and paper industry, Saw mills, *Water quality control, Industrial wastes, Municipal wastes.
Identifiers: Willamette Riv Basin (Oreg.).

This report is the result of a in-depth study of the water quality of the Willamette River system, uses of the system, factors that affect water quality, probable nature of the economic development of the watershed and its impact on water quality, and the nature of measures to be taken both to abate pollution and prevent reoccurrence of pollution.
W69-01120

MANPOWER AND TRAINING NEEDS IN WATER POLLUTION CONTROL.

For primary bibliographic entry see Field 09A.
For abstract, see .
W69-01124

INVENTORY OF RESEARCH IN WATER POLLUTION AND RELATED FIELDS: COLUMBIA BASIN AND PACIFIC COAST STATES.
Federal Water Pollution Control Administration, Corvallis, Oreg.

For primary bibliographic entry see Field 09D.
For abstract, see .
W69-01125

THEORETICAL CONCEPT OF OXYGEN TRANSFER IN GAS BUBBLE AERATION SYSTEM.

Rhode Island Univ, Kingston.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01129

U-TUBE AERATION.

New Mexico State Univ, Las Cruces.
Richard E. Speece, and Jack L. Adams.
Tech Rep 38, Water Resour Res Inst, June 1967. 77 p, 26 fig, 3 tab, 8 ref, 2 append. OWRR Project A-011-NMx.

Descriptors: Water pollution, *Oxygen sag, Free surfaces, Diffusion, Air-water interfaces, *Dissolved oxygen, *Aeration, Dissolved solids, Solubility, Saturation, Oxygen, Low flow, Bubbles.

The diffused air U-tube aerator is especially adapted to capitalize on factors which increase oxygen transfer from air to water. It allows the contact time between the air bubble and water to be increased. The air-water interfacial area can be easily controlled. It allows the DO deficit to be increased. Finally, the diffused air U-tube aerator allows operation under a positive, zero, or negative head. Results of experimentation show that oxygen transfer in the U-tube is a function of air-water ratio, depth of U-tube, nominal water velocity, and air diffuser submergence. Results with pure oxygen injection showed about 5-fold increase in DO over air injection. A U-tube 40-ft deep, with a nominal water velocity of 8.4 ft/sec, and air injected at 1-ft submergence raised the DO from 0.2 to 4.0 mg/l. Difference in free water surface across the system was 5 in. Under the above conditions 13.8 lb of oxygen was transferred per hp-hr. Under conditions where 5 in. of head efficiency would be 85.4 lb of oxygen per hp-hr. Under standardized conditions, oxygen transfer rates in excess of 20 lb of oxygen per hp-hr were achieved.
W69-01132

TIME-INTEGRATED THERMAL EFFECTS OF FOREST IRRIGATION.

Pennsylvania State Univ, University Park.
Richard Lee, and William E. Sharpe.
Pap, 8th Nat Conf Gr Meterol, Ottawa, Canada, May 1968. 16 p, 5 fig, 5 tab, 24 ref. OWRR Project A-012-Pa.

Descriptors: *Forestry, Irrigation, *Temperature, Energy balance, Trees, Ecology, Sewage effluents, *Sewage treatment, Sensors, *Forests, Instrumentation, *Sprinkler irrigation, *Heat, Heat budget, *Waste treatment.

Changes of forest microclimates are reported as reflected in mean temperatures at various levels in treated stands. Irrigation treatments of 1 or 2 in. of treated municipal effluent were applied weekly, April through October 1967. The effluent was disinfected, clear, and odorless but not potable. Sprinklers were located 3 ft above ground level or above the canopies. Temperature sensors were placed in the upper 6 in. of mineral soil, 4-1/2 ft, and at 3 levels in the canopy, 28-, 33-, and 38-ft heights in Red Pine and 33-, 43-, and 53-ft heights in the hardwoods. A special temperature-sensing technique integration was used. Results of the investigation, with interpretation and significance are given.
W69-01141

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

INSECTICIDE ADSORPTION BY LAKE SEDIMENTS AS A FACTOR CONTROLLING INSECTICIDE ACCUMULATION IN LAKES, Wisconsin Univ, Madison, Wisconsin.

Erik G. Lotse, Gordon Chesters Graetz, and Gerhard B. Lee.
Rep, July 25, 1967. 42 p, 10 fig, 10 tab, 5 ref.
OWRR Project B-008-WIS.

Descriptors: Adsorption, Pesticide kinetics, *Insecticides, Bottom sediments, Lake soils, Radiochemical analysis, Organic matter, Bonding, Clay minerals, Particle size.

Identifiers: Chlorinated hydrocarbons, Multiple regression, Lindane.

Lindane (gamma isomer of benzene hexachloride) adsorption was determined on eight intact lake sediments using a radiochemical technique. Lindane adsorption was shown to be affected by sediment suspension concentration, organic matter content, lindane concentration, clay content and lindane-sediment ratio and to obey Freundlich's equation. As the lindane molecule is neutral and not subject to ionization, van der Waals forces and hydrogen bonding were considered the most feasible adsorption mechanisms. The chlorine atoms of lindane are the most likely bonding sites to hydroxyl groups residing on the surfaces of the organic and mineral components of the sediments.
W69-01165

TRICKLING FILTERS AS A DAIRY-MANURE STABILIZATION COMPONENT, Massachusetts Univ, Amherst.

D. O. Bridgman, and J. T. Clayton.
Manage Farm Animal Wastes, Amer Soc Agr Eng, St. Joseph, Mich, pp 66-68, 1966. 3 p, 6 fig, 3 tab, 9 ref.
OWRR Project A-009-MASS.

Descriptors: *Trickling filters, Filters, *Waste treatment, Sewage effluents, *Farm wastes, Effluents, Settling Basins, *Cattle, *Dairy industry, Wastes, Biochemical oxygen demand, Pollution abatement.

Trickling filters are an effective means of reducing the polluting qualities of dairy manure and a possible means of treating effluent for discharge or recirculation. Loading rate and waste temperature have a great effect on the quality of the effluent. Nine points were plotted for this experiment and labeled according to average BOD of the effluent under respective conditions. Assuming a linear relationship between points, a topograph was drawn for various qualities of effluent. With bubbling aeration, a 1000-lb cow would require 334 cu ft of storage and treatment volume for 6 months of operation between sludge removals. An aeration tank, 134 cu ft in volume, was operated at 95 deg F. The estimated size for 70 deg F operation was 200 cu ft. Experiments support Webster's value for sizing primary sedimentation tanks of 200 cu ft per cow for biannual sludge removal. Test results show the volume of trickling filter required per cow to meet specific temperatures and effluent qualities. Experiments suggest a sedimentation tank volume of about 114 cu ft per cow instead of the 248 cu ft actually used. Therefore, a trickling filter system would require from 346 to 391 cu ft of tanks per cow to produce an effluent BOD of 200 ppm.
W69-01156

POLLUTION OF WATERWAYS IN THE ELLIOT LAKE AREA, ONTARIO, Western Ontario Univ, London, Ontario, Canada.

Richard P. W. McCutcheon.
Ontario Geogr, No 2, pp 25-33, 1968. 9 p, 1 fig, 5 ref.

Descriptors: *Water pollution, *Mine wastes, *Radioactive wastes, *Municipal wastes, Aquatic algae, Uranium radioisotopes, Radium radioisotopes.

Identifiers: Elliot Lake, Ontario.

Rapid development of uranium mining in the Elliot Lake area, Ontario, caused widespread radiological and sewage pollution of the Serpent River system. The widely used acid leaching process of uranium ore treatment produces large amounts of waste, both solid and liquid. For each ton of ore, nearly 1 ton of tailings and at least 2 tons and as much as 5 tons of water, acids, and neutralizers are produced. Not all the uranium, and none of the Radium-226, is extracted from the ore, so the tailings piles contribute some radioactivity to water passing through them. Some lakes and streams contain more than the safe amount of radium. Leaks in the refining systems also contribute pollution. All sewage is treated, but lake and stream pollution by increased oxygen demand and increase of nutrients is common and has made one former swimming area obnoxious. No fish can live in Angel and Horne Lakes, and algae are present in excessive amounts.
(Knapp-USGS)
W69-01165

A TEST OF FLUSHING PROCEDURES TO CONTROL SALT-WATER INTRUSION AT THE W P FRANKLIN DAM, NEAR FT MYERS, FLORIDA,

U.S Geological Survey.
Durward H. Bogges
U.S Geol Surv open-file rep, 20 p, 1968. 8 fig, 3 tab, 1 ref.

Descriptors: *Encroachment, *Saline water, *Gate control, *Locks, *Flow control, Navigation, Florida, Boating, Recreation.

Identifiers: Fort Myers (Florida), Lockage, Flushing.

A test was made of procedures to control salt water intrusion during lockage of boats at W P Franklin Dam near Ft Myers, Fla. Near the end of the dry season, in May 1967, the chloride content of river water about 3/4 mile upstream from the lock was about 500 mg/l. In early Mar 1968, the chloride content was about 250 mg/l. Proposed tests included flushing the lock chamber by partial opening of the downstream gate and full opening of the upstream gates prior to lockages, scheduling lockages instead of performing them on demand, and flushing during lockages. A test of flushing before lockages was performed. Salt water was flushed from the lock chamber with gate openings of 4, 6, and 8 ft. An opening of 8 ft or more appears preferable because of the smaller volume of water required and less discharge time involved. It is questionable whether sufficient quantities of water will be available for flushing. For example, assuming that the volume of water needed is about 340 acre ft per day (170 cfs), then more than 10,000 acre ft would be required for a 30 day period. For 68 consecutive days between Mar and June 1967, no water other than lockage and leakage was discharged, and for 77 consecutive days discharge was less than 170 cfs. This long period of low flow may represent near extreme conditions, but the availability of water required for flushing should be assured if these procedures are to be adopted. (Knapp-USGS)
W69-01168

CHEMICAL QUALITY OF WATERS OF BROWARD COUNTY, FLORIDA, U.S Geol Surv.

Rodney G. Grantham, and C. B. Sherwood.
Florida Div of Geol Rep of Invest No 51, 52 p, 1968. 16 fig, 3 tab, 18 ref.

Descriptors: *Chemical properties, *Florida, *Aqueifer characteristics, Surface-groundwater relationships, Water pollution, Water quality.

Identifiers: *Broward County, Herbicide pollution, Canal water.

Results of a water resources study which emphasizes the chemical quality of waters in Broward County, Florida, are presented. The water is calcium bicarbonate and ranges from hard to very hard, and from neutral to slightly alkaline.

Most of the water used in the County is obtained from the Biscayne aquifer, recharged by local rainfall and by water that infiltrates from the canals. The chemical quality in the interrelated surface and groundwater system is generally good. The Floridan aquifer yields brackish water by artesian flow; sewage is disposed in the aquifer at one location. Chemical weed killers applied on the land, as well as detergents, have been detected in the groundwater, indicating movement of waste through the ground. The chemical quality of surface water varies seasonally. The mineral content of canal water does not exceed 550 ppm. Continued monitoring of saltwater intrusion and waste disposal effects is necessary to help prevent future contamination. (Llaverias-USGS)
W69-01171

06. WATER RESOURCES PLANNING

6A. Techniques OF Planning

MANAGEMENT OF HYDROLOGIC SYSTEMS FOR WATER QUALITY CONTROL, California Univ., Berkeley.

Philip C. Woods.
Water Resource Center, San Eng Res Lab, Contrib 121, June 1967. 121 p, 39 fig, 4 tab, 56 ref, append.
OWRR Project A-004-Cal.

Descriptors: *Water quality, *Water management, Hydrology, Irrigation, *Irrigation practices, Simulation, Irrigation O and M, Groundwater flow, Computer programming, Ground water, Salinity, Salts, Mathematical analysis, Control, Water pollution, Bibliographies, California, *Water quality control, Mathematical models.

Identifiers: *Hydrologic models, Sacramento River, Calif.

By a series of mathematical models and digital computer techniques an approach was made to predicting the water quality response of hydrologic systems to changes in irrigation practice. The results obtained by simulating the Sacramento River System were compared to the quality response of the prototype. The potentialities of simulation in systems management were illustrated using the 'X' Hydrologic System. Its sensitivity to incorrect selection of parameter values was examined, as were the system changes that could be induced by altering parameters which are subject to management decisions. From the results it can be expected that a simulation approach will lead to the development of dependable optimizing techniques, the ultimate goal of water quality management. (McGauhey-Calif)
W69-00724

MANAGEMENT MODELS FOR WATER RESOURCE SYSTEMS, Cornell Univ., Ithaca, N. Y.

Daniel P. Loucks.
Water Resour Center, Tech Rep 1, June 1967. 130 p, 12 fig, 8 tab, 246 ref, 7 append. OWRR Project A-002-NY.

Descriptors: *Systems analysis, *Water management (Applied), Reservoir operation, Water quality, Flow control, Linear programming, Decision making, *Water resources, Policy matters, Mathematical models.

Analytical methods are presented to assist in the establishment of policies for managing developed river systems. Both deterministic and stochastic linear programming models are structured for determining reservoir releases and allocations of water to each flow and stock use that meet some management objective. Three possible objectives are discussed and incorporated into the models, namely maximization of total expected net losses, and minimization of total expected deviation from

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each use or expected allocation. This latter is suggested if no economic benefit-loss data are available. Two deterministic linear programming models for water quality management are discussed. These models indicate the minimum cost required to maintain particular dissolved oxygen standards within the system and increase in costs resulting from any social, legal or administrative constraints. Extensions of these models and some economic implications are presented in the appendix.

W69-00737

MANAGEMENT OF HYDROLOGIC SYSTEMS FOR WATER QUALITY CONTROL,
California University, Berkeley, Water Resources Center.

For primary bibliographic entry see Field 03B.
For abstract, see .

W69-00938

PROBLEM OF ALTERNATIVES IN WATER RESOURCE MANAGEMENT,

Resources for the Future, Washington, D. C.

Robert K. Davis.

The Range of Choice in Water Management, 1968, Chap 1, p 3-10, 2 ref.

Descriptors: Water resource management, Federal project planning, Evaluation, Project planning, Institutional constraints, *Political aspects, Administrative decisions, Assessments, Intangible benefits, Social values, *Optimum development plans, Jurisdiction.

Identifiers: Operating responsibility, *Assessment of alternatives, Technology.

Several important questions should be asked in considering the probable implementation of alternatives: (1) How broad an array of alternatives are technically possible; (2) What analytic problems do they present; (3) What institutional or procedural forms might be obstacles to certain alternatives; (4) How can planners be encouraged to explore the range of choice. The comparison of alternatives, including their measurable costs and returns, as well as their difficult-to-measure consequences, provides the best basis we have for intelligent consideration of important intangible values. However, this practice of comparison has not been put into effect. One reason is the technical difficulty of presenting all the alternatives. Five factors contribute to this problem: (1) various combinations of variables make the number of alternatives to be considered enormous, (2) deficient physical and biological knowledge, (3) inability to competently assess economic and social factors, (4) changing technology, (5) difficulty of assessing intangible benefits and costs. These factors make it difficult to define an optimum solution in an objective manner. Several features of the institutional environment also inhibit and complicate the task of exploring and evaluating alternatives. These are (1) limited jurisdiction of water agencies, (2) political bias in favor of certain alternatives, and (3) an agency's adaptability is limited by past perceptions and solution of problems. (Gargola-Chicago)

W69-00950

THE OPTIMIZATION OF LARGE SCALE WATER RESOURCE SYSTEMS: OPERATIONAL ASPECTS, PART 1: CONCEPTUAL FRAMEWORK,

California Univ., Los Angeles.

Nathan Buras.

University of California, Sept 1965, 34 p, 8 fig, 8 ref.

Descriptors: Computer programs, Reservoirs, Data processing, *Dynamic programming, Linear programming, Water utilization, Optimum development plans, Hydrological data, *Mathematical models, Hydroelectric power, Water supply, Dimensional analysis.

Identifiers: Trinity Reservoir, Folsom Reservoir, Oroville Reservoir, Shasta Reservoir, Optimal operating procedure, California.

A water resource system consisting of four reservoirs was analyzed with respect to its operation in an integrated manner. The reservoirs release water for irrigation and municipal and industrial use, and for the generation of hydro-electric power. It is required to (1) determine the maximum amount of firm water and firm power which may be produced by the system, and (2) determine an optimal operating procedure for the satisfaction of the target outputs determined by (1) above. Only part (1) was discussed. The optimization of the entire system using dynamic programming was found to be unfeasible due to the large dimensionality of the problem: at least one dimension for each reservoir of subsystem. Consequently, the decomposition principle was applied using a combination of dynamic programming (for the optimization of each subsystem) and linear programming (for the optimization of the master program). Hydrological data covering ten consecutive years and including lowest inflows on record were supplied so that ten different values of firm water and firm power may be calculated. On the basis of these results, the target outputs for the system as a whole, in terms of firm water and firm power, may be determined. (Gargola-Chicago)

W69-00961

MATHEMATICAL ASSESSMENT OF SYNTHETIC HYDROLOGY,
U. S. Geological Survey, Washington, D. C.
N. C. Matalas.

Water Resources Res, Vol 3, No 4, pp 937-945,

1967. 9 p, 12 ref.

Descriptors: *Synthetic hydrology, Markov processes, Mathematical models, Stochastic processes, Statistical methods.

To generate multivariate synthetic sequences that will resemble multivariate historic sequences in terms of means, standard deviations, skewnesses, lag-one serial correlation, and lag-zero cross-correlations, a multivariate, weakly stationary process is used. Techniques of regionalization and maximum likelihood estimates may be used to minimize the biases associated with the estimates of the parameters that characterize the historic sequences. (Author)

W69-01056

SYNTHETIC HYDROLOGY BASED ON REGIONAL STATISTICAL PARAMETERS,
U. S. Geological Survey, Washington, D. C.
M. A. Benson, and N. C. Matalas.

Water Resources Res, Vol 3, No 4, pp 931-935,

1967. 5 p, 3 tab, 8 ref.

Descriptors: *Synthetic hydrology, *Regression analysis, Stochastic processes, Mathematical models, Sampling, Statistical methods.

The subject of synthetic hydrology, the generation of a long series of hydrologic events by use of the statistical parameters based on a short sample, is reviewed. A method is proposed to correct deficiencies caused by large original sampling errors and the lack of a way to generate series for ungaged locations. All the longer streamflow records in a region are used and the relations between the variables are determined by standard multiple regression methods. The relations are based essentially on a random sampling of the variables, so they are applicable to all basins, gaged or ungaged, in a studied region; their use reduces short-sample error. Relations defining statistical parameters for the Potomac basin are presented as an example of the method. (Knapp-USGS)

W69-01057

BROAD HORIZONS IN WATER RESOURCE PLANNING AND INVESTMENT,

Resources for the Future, Washington, D. C.

Charles W. Howe.

Water Resources Research, Vol 2, No 4, pp 843-847, Fourth Quarter 1966. 1 tab, 7 ref.

Descriptors: *Planning, Water resources, Investment, Governments, Benefit-cost ratio, Costs, Harbors.

Identifiers: Public policy, Private enterprise.

In spite of the vastly expanded knowledge and computational abilities available in the planning of water resource systems, the scope of most planning efforts remains too narrow. It is argued that planning efforts must be broadened in three ways: (1) geographically, to take into account not only hydrological interdependences but the wider range of market and financial relationships; (2) between public and private sectors to assure that public investments yield sufficiently high returns; (3) to encompass all relevant alternatives, both technological and institutional, for attaining the objectives of development. Examples of the costs resulting from the failure to use sufficiently broad horizons in planning are provided for several water resource problems. (Seneca-Rutgers)

W69-01069

CAN WE SOLVE OUR WATER PROBLEMS,
Resources for the Future, Washington, D. C.

Irving K. Fox.

Water Resources Research, Vol 2, No 4, pp 617-623, Fourth Quarter 1966. 7 ref.

Descriptors: Costs, Return, *Administration, Irrigation, *Water resources, *Legislation, *Water supply, Water quality, Water Resources Planning Act, Governments.

Identifiers: Public policy, Private enterprise.

Water problems may be thought of as occurring in three major areas. One problem area is the urgent need of maintaining a continuously advancing science and technology, especially in water quality management. Another problem area is that of balancing costs and returns from water development and use. It has proven to be uncommonly difficult to achieve a consensus on costs and returns, which, in turn, has often made it difficult to proceed with water programs. A third problem area stems from the inadequacy of water management institutions. Laws, policies, and organizational arrangements have not kept abreast of the requirements of a rising demand and an advanced technology. In recent years we have greatly improved our ability to deal with these problems. Recent action by both government and private organizations reflect a determination to solve the problems which remain. Three key issues now merit priority attention: (1) finding better ways of providing officials and the public with authoritative information; (2) establishing institutions capable of operating complex water management programs; (3) modifying public policy to improve the performance of private enterprise. (Seneca-Rutgers)

W69-01070

STORAGE REQUIREMENTS FOR WATER IN THE UNITED STATES,

Resources for the Future, Washington, D. C. and U. S. Geological Survey, Washington, D. C.

For primary bibliographic entry see Field 06D.

For abstract, see .

W69-01073

ON RESERVOIR SITE PRESERVATION POLICY,

Resources for the Future, Washington, D. C.

Allen V. Kneese.

Water Resources Research, Vol 2, No 3, pp 607-614, Third Quarter 1966 3 ref.

Descriptors: *Reservoir sites, *Pre-impoundment, Costs, *Value, Market value, Property values, Economic efficiency, Legislation, Governments, *Regulation, Taxes, *Zoning, Planning.

Identifiers: *Reservoir site preservation policy, Opportunity costs, Equity, Government acquisition, Development rights.

Field 06—WATER RESOURCES PLANNING

Group 6A—Techniques of Planning

It is not obvious that reservoir site preservation policies should be adopted. Before such a policy is implemented, consideration should be given to the value of the sites for alternative uses. In some cases the free market registers these opportunity costs accurately. However, under certain circumstances the free market prices do not reflect these costs. For example, the market price of land may be bid up in anticipation of its purchase as a reservoir site. Public action to preserve reservoir sites could depend upon one of three governmental powers: the power to regulate the use of property, the power to acquire property and the power to tax. There are many methods of site preservation. These methods can be evaluated in terms of the following criteria: (1) economic efficiency, (2) equity, (3) public outlay required, (4) changes in the law required. Various methods such as zoning, acquisition and compensable regulations are analyzed on the basis of these criteria. The analysis suggests the compensable regulations may be the most basic device for the preservation of reservoir sites, although other devices might be more effective in particular situations. (Seneca-Rutgers)

W69-01080

WATER PRICING: A SOCIAL DECISION-MAKING PROCESS,

California Univ., Los Angeles.

For primary bibliographic entry see Field 06C.

For abstract, see .

W69-01082

AN OPTIMIZATION METHOD FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS,

Texas A and M Univ., College Station and Texas Univ., Austin.

W. L. Meier, Jr., and C. S. Beightler.

Water Resources Research, Vol 3, No 3, pp 645-652, Third Quarter 1967. 6 fig, 11 ref.

Descriptors: *Optimization, *Dynamic programming, Planning, River systems, River basins, Reservoir, Water resources development.

Identifiers: *Nonserial systems, *Serial systems, *Multi-stage process, State, Decision, Stage, Return, Transition, Cut state.

Several optimization procedures have been proposed for the analysis of complex water resource planning problems. One of these techniques, dynamic programming, has been limited in its applicability to river basin systems because these systems are nonserial and dynamic programming is by nature a serial procedure. Recently developed methods are discussed and illustrated with example problems for decomposing the nonserial river basin system into equivalent serial systems amenable to analysis by the dynamic programming method. (Seneca-Rutgers)

W69-01092

TOWARD COMPREHENSIVE WATER RESOURCES MANAGEMENT IN THE CALUMET UNION DRAINAGE SYSTEM.

Northeastern Illinois Planning Commission, Chicago, Ill.

Report Northeastern Illinois Planning Commission, Chicago, Ill, 1966, 16 p, 3 fig, 1 tab, 6 ref.

Descriptors: Local governments, Water resources management, *Interagency cooperation, *Project planning, Project purposes, Formulation, Urbanization, Social needs, State governments, *Flood control, Multipurpose projects, Community development, Low flow augmentation.

Identifiers: Calumet Union Drainage System.

In the Calumet Union Drainage System, flooding is a significant problem. It is of short duration and occurs at infrequent intervals. This general situation is reviewed in terms of the blight it has created. This area cannot afford the luxury of a single-purpose flood control project where inadequate flow,

urban ugliness, and slum housing exist and are associated with the flood problem. Suggested improvements by the Army Corps of Engineers, U. S. Geological Survey, various State agencies, the Metropolitan Sanitary District of Greater Chicago, and the Illinois Division of Waterways are given. The Northeastern Illinois Planning Commission outlines its own plan. Easy accessibility to surrounding municipalities demand that the potential recreational value of the site be utilized. A recreational lake with adjacent field for storage of flood waters is proposed. Housing or a community college could be built by the lake. Organization for this plan could be handled through the Urban Renewal Board. Steps following that are defined and agencies that would be involved in any development of the area are outlined. (Gargola-Chicago)

W69-01093

NORTHEASTERN ILLINOIS WATER RESOURCE ORGANIZATION INQUIRY.

Illinois Department of Business and Economic Development, Springfield, Illinois.

Report, Northeastern Illinois Planning Commission, Chicago, Feb 1968. 11 pp.

Descriptors: Decision making, Adoption of practices, Water resource development, Administrative procedure, Community development, State governments, Administrative agencies, Project planning, *Interagency cooperation, *Regional planning, *Future planning, Short term planning, Long term planning, Management, Institutional constraints.

Identifiers: Northeastern Illinois.

To consider possible methods of organizing for coordinated water resources planning and development in Northeastern Illinois four groups were called together. Consultants, suburban managers, technical advisors, and a planning commission subcommittee, reviewed (1) organizational needs, functions and programs, (2) structural form, and (3) enforcement factors. There was general agreement on the need to begin with coordination and mutual adjustment of existing programs. Short and long range planning must be provided in order to meet immediate critical requirements and prepare for future development. A form of regional management was generally approved to be the best system for water resource management planning as well as operational coordination. The Planning Commission should continue to play a major role in water resource planning and the coordination of this with other aspects of comprehensive planning for the region. Subcommittee findings and recommendations are summarized with suggestions for meeting critical immediate requirements. (Gargola-Chicago)

W69-01094

PRODUCTION TECHNOLOGY IMPERFECT COMPETITION, AND THE THEORY OF LOCATION: A THEORETICAL APPROACH,

Wisconsin Univ., Madison.

Gilbert A. Churchill, Jr.

Southern Economic Journal, Vol 34, No 1, pp 86-100, July 1967. 2 fig.

Descriptors: *Industrial plants, *Sites, Costs, Initial costs, Competition, Demand.

Identifiers: *Facility location analysis, *Location theory, *Production technology, *Imperfect competition, Plant size.

Facility location analysis is used to determine the best location for a single firm. The author attempts to extend the theory of facility location in several ways: (1) by introducing more realistic transport costs; (2) by including imperfectly competitive factor markets within a location model; (3) by explicitly incorporating plant size within a spatial model; (4) by treating production technology directly, thereby allowing factor substitutions with output changes at each site; and (5) by introducing

monopolistic competition in the product market which is attributable to product differences rather than to competitor locations. The extensions are demonstrated with a theoretical 'point' location model. The model is developed from the vantage point of a single firm faced with the location decision. Hypothetical functions are used to develop the model. It is assumed that the firm attempt to maximize profits and this single consideration guides the determination of the level at which output should be planned as well as where the product should be produced. Within his spatial model, the author attempts to integrate stock-flow production theory, transportation economics and existing location theory. (Seneca-Rutgers)

W69-01098

INDIVIDUAL PREFERENCE INTRANSITIVITY,

Southampton Coll., Long Island, N. Y.

Arnold A. Weinstein.

The Southern Economic Journal, Vol 34, No 3, pp 335-343, January 1968. 2 fig.

Descriptors: Psychological aspects, Decision making.

Identifiers: Choice, *Preference patterns, *Intransitivity, Indifference curve analysis, Bands of indecision, Rationality.

The causes of observed individual intransitivities are divided into five categories: (1) true irrationality of a clinical nature as; (a) the situation where the thought of one alternative affects the desirability of another alternative; (b) conflict between the superego and the id or ego; (c) the desocialized or unsocialized individual; and (d) role conflict; (2) observed intransitivities caused by; (a) the lack of communications between the experimenter and subject; (b) the subject's changing tastes; (c) boredom with the experiment; (d) playing a game with the experiment; or (e) the experimenter asking the wrong question; (3) observed intransitivities caused by non-allowance for indifference; (4) true intransitivities caused by man's imperfect sensitivity to his environment or himself and (5) rational intransitivities due to the high cost of holding a preference ordering. If verified, the last cause leads to a modification of indifference curve analysis which would significantly affect the derivation of Pareto optimality by market conditions. A conceptual tool entitled 'Bands of Indecision' is developed to demonstrate this condition. (Seneca-Rutgers)

W69-01100

SOME BOUNDS UPON THE PARETO OPTIMALITY OF GROUP BEHAVIOR,

Australian National Univ., and Princeton Univ.,

New Jersey.

Clem Tisdell.

Kyklos, Vol XIX, No 1, pp 81-104, First Quarter 1966.

Descriptors: *Welfare, *Model studies.

Identifiers: Conflict of interest, *Pareto optimality, *Group behavior, Maximization, *Interdependence, *Game theory, Uncertainty.

This article puts special emphasis upon those obstacles to the Pareto optimality of group behavior which arise from the imperfection of man's knowledge. Bounds upon Pareto optimal behavior are discussed for three limiting societies: (1) a society in which all members are independent, (2) one in which only one-way dependencies can arise, and (3) one in which all members are completely interdependent. Insights drawn from these cases can be used in discussing non-limiting ones. Account is then taken of the fact that few groups exist in isolation and some formal conditions, which may often make it impossible for a group to achieve a Pareto optimality, are stated. It is shown that Pareto optimality of group behavior is limited by factors such as individual's imperfect knowledge of their own preferences, barriers to discovering the preferences of others, limitations imposed by the good faith of parties to agreement, the intrusion of emotional factors, e.g., in bargaining false notions

by individuals of their own predictive powers, and by other uncertainties about possible acts and the relationship between acts and outcomes. (Seneca-Rutgers)
W69-01102

A NOTE ON CONSUMER BEHAVIOR IN AN URBAN HIERARCHY, Canterbury Univ, New Zealand and National Univ, Australia.

R. J. Johnston, and Peter J. Rimmer.
Journ of Regional Science, Vol 7, No 2, pp 161-166, Winter 1967. 2 fig, 2 tab, 3 ref.

Descriptors: *Demand, *Behavior, *Cities.
Identifiers: *Consumer behavior, Central place theory, Rationality, Australia.

The structural concepts of central place theory, including the idea of hierarchy, are based on a number of assumptions concerning consumer behavior. All of the assumptions imply rational human actions and complete knowledge. This article makes an investigation into the validity of these assumptions, using a series of small towns in Victoria, Australia as its study area. A sample of residents were questioned on their normal shopping habits. The tabulated results indicate that this behavior does not generally accord with the assumptions of central place theory. Part of the explanation of this lies in the extreme primacy of Melbourne within Victoria so further research is necessary within other urban systems. (Seneca-Rutgers)
W69-01109

APPLICATION OF ELECTRONIC ANALOG COMPUTER TO SOLUTION OF HYDROLOGIC AND RIVER-BASIN-PLANNING PROBLEMS: UTAH SIMULATION MODEL II,

Utah State Univ, Logan.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-01145

THE VALUE OF A TROUT STREAM FISHERY, Utah State Univ, Logan.

Archie A. Dyer.
Final Rep Utah Water Resour Res, Dec 1967. 49 p, 5 fig, 12 tab, 18 ref, append. OWRR Project B-008-UTAH.

Descriptors: *Recreation, Competing uses, Value, Cost benefit analysis, Social values, Economic prediction, Regression analysis, Utah, Income, Age, *Trout, Sport fish, *Fisheries, Fishing.

The data analysis indicated that travel distance, user age, and user income level are important determinants of use of trout streams. These variables were incorporated into regression analysis to develop a use-prediction model. This model was used to determine predicted use levels of sample streams. The predicted use levels combined with travel costs and expenditures on new fishing equipment were used to derive a statistical estimate of the demand schedules for the sample streams. These statistical demand curves were subjected to consumer surplus procedures to determine the values of the sample streams.
W69-01147

6B. Evaluation Process

NEW HORIZONS IN WATER RESOURCES ADMINISTRATION, Resources for the Future.

Irving K. Fox.
Public Administration Review, Vol. 25, No. 1, 1965, p 61-69, 29 ref.

Descriptors: Resource development, Interest rate, Indirect benefits, Intangible benefits, Systems analysis, *Interagency cooperation, *Decision-making, Water resource development, Project planning, Political aspects, Administrative decisions, Ad-

ministrative agencies, *Economic evaluation, Optimum development plans, Regional analysis, *Welfare economics.
Identifiers: Projection of demand, Market process.

The significant developments in water resource activities are reviewed for the past fifteen years. The search for efficiency is explored, with emphasis on the applicability of welfare economic theory. The major problems in evaluating water resource investments—secondary benefits, range of alternatives, projections of demand, and consideration of variables—are discussed. Three measures: (1) adoption of policies which rely on market-like processes; (2) restructuring policy patterns, agency authority and responsibility; and, (3) making greater use of countervailing influences are suggested for achieving greater efficiency in development. It is concluded that research in policy-institutional structure is far behind technical aspects of water resource development, and must be improved to better implement future planning. (Gar-gola-Chicago)
W69-00705

LOCAL ACTION AND ACCEPTANCE OF WATERSHED DEVELOPMENT, Mississippi State Univ., State College.

For primary bibliographic entry see Field 04D.
For abstract, see .

W69-00716

THE PRESENT AND FUTURE GROUND WATER SUPPLY OF THE BATON ROUGE AREA,

Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-00720

WATER FOR TEXAS.

Texas A and M Univ., College Station.

Proc 11th Annu Conf, Water for Texas, Nov 21-22, 1966. 66 p, 10 fig, 3 tab, 57 ref.

Descriptors: *Water resources, *Water resources development, Weather modification, Planning, Evaporation control, Estuaries, Recreation, Water management (Applied), Fish establishment, Water quality, Water reuse, *Water utilization, Water development, Water law, Pollution abatement, Texas, Bibliographies.
Identifiers: *Water use, Water plans.

The Proceedings of the 11th Annual Water for Texas Conference held at Texas A and M University, College Station, Tex, Nov 21-22, 1966, include 13 papers developing the theme Challenges of the Present. Developing Total Resource, Estuarine Problems, and Recreational Impact are subthemes representing water resource problem areas which need immediate attention if Texas is to meet the challenge of effective utilization of water resources. Concepts set forth by recognized authorities on water resource planning will be of value to water planners and researchers as Texas water problems are considered in the immediate future.
W69-00725

SOCIOLOGICAL FACTORS IN WATERSHED DEVELOPMENT,

Mississippi State Univ., State College.
Kenneth P. Wilkinson, and Lucy W. Cole.
Water Resources Res Inst Rep, Jul 1967. 48 p, 127 ref. OWRR Project A015-Miss.

Descriptors: *Project planning, Water resources development, *Community development, Economics, *Social aspects, Social impact, Watersheds, Social participation, Sociology, Social sciences, Small watersheds, Watershed management.
Identifiers: Water resources management, Social acceptance.

The technical process of watershed project action is often hindered by social problems. Increasing awareness by program administrators has resulted in a search for scientific approaches to citizen involvement in watershed planning. Sociological resources relevant to water-related problems have rarely been applied in other than superficial ways. A strategy is proposed by which sociological research can be more effectively oriented to problems experienced by water management professionals. A sociological field theory is outlined as foundation for the needed program of research. A review of social science literature concerning watershed action reveals a variety of findings and hypotheses for research, but little sustained integration of theory with findings. Analysis of data on watershed needs and projects in Mississippi as related to demographic and social-organizational characteristics of communities yields findings which are suggestive of a relationship. The general conclusion reached is that rigorous efforts in theoretical and operational development will be necessary to assess the influence of community forces in watershed development.
W69-00732

AN ACT CREATING THE WATER RESOURCES BOARD, DEFINING ITS POWERS AND DUTIES.

Illinois Laws 1967, Act 1191.

Descriptors: *Illinois, United States, Legislation, *Water Resources Development, Universities, Financing, Water utilization, Land resources, Projects, Navigation, Flood control, Rivers, Bodies of water, Watersheds (Basins), Local government.
Identifiers: Water Resources Board, Resources Development Act.

The composition and financing for the Water Resources Board is described. The Board's functions are: to inform citizens of the condition of water and related land resources; to advise the Governor on legislation; to coordinate activities of state agencies; to examine the effects of state programs; to review proposed projects to determine priorities; to act for the state on projects for the improvement of navigation, flood control or for purposes of the United States involving rivers, waters or watersheds; to administer financial assistance to local governments for water resources planning; to establish and supervise regional water resources management commissions; to receive funds; and to administer the Resources Development Act. (Childs-Fla)
W69-00755

DESIRABLE FEATURES OF WATER RIGHTS LAWS,

Nebraska Dept of Water Resources, Lincoln, Nebr.
Dan S. Jones.

J of the Irrigation and Drainage Division, Proceedings of the American Society of Civil Engineers, Vol 89, No 1R4, part 1, pp 1-6, Dec 1963.

Descriptors: Irrigation, *Water rights, Water distribution (Applied), Water law, Preferences (Water rights), Appropriation, Prior appropriation, Surface waters, Stream gages, Groundwater, *Nebraska, Riparian rights, Competing uses, *Legal aspects, Federal-state water rights conflicts, *Water allocation (Policy).

The coexistence of the riparian and appropriation doctrines creates uncertainty and makes orderly administration of the law difficult. The law should declare that all waters of the state are public and are subject to appropriation and use as provided by law. All uses of water, except for ordinary household purposes, should be subject to control by one central state administrative agency having authority to police the streams, to grant water rights, and to cancel such rights when the appropriator ceases to use the water for the purpose for which the appropriation was granted. The decisions of the administrative agency should be appealable directly to the Supreme Court. The law

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Group 6B—Evaluation Process

should indicate certain preferential uses of water and the use of water for such a purpose should be permitted provided that a prior appropriator for an inferior purpose is adequately compensated for any interference resulting therefrom. The water rights law should apply equally to all who desire to use the public waters, including agencies of the United States. (R. Smith-Fla)
W69-00760

AN ACT CONCERNING LONG RANGE WATER RESOURCES PLANNING.

Connecticut Public Act No 477 (1967).

Descriptors: *Planning, *Connecticut, Long-term planning, Project planning, Administrative agencies, Budgeting, Coordination, Legislation, Water resources development, Water allocation (Policy), Water utilizations, State governments, Local governments, Water policy, Administration, Water supply, Water resources.

The act provides for the formulation of a long-range statewide plan for the management of the water resources of the state. The Water Resources Commission, the State Department of Health, the State Board of Fisheries and Game, and the Connecticut Development Commission are responsible for preparing the plan. They are to design a unified planning program, coordinate regional water and sewer plans and assist local planning. The act sets up objectives and guidelines for the plan and provides for its submission to the general assembly. (Horner-Fla)
W69-00776

DELAWARE RIVER BASIN COMMISSION.

18 CFR Ch 3, Sec 401.0-401.52 (1968).

Descriptors: *Delaware, *Delaware River Basin Commission, Conservation, Legislation, *Water resources, River basin development, Impoundments, Ground water, Sewage treatment, Surface water, Dredging, Bridges, Projects, Administrative agencies.

Identifiers: *Comprehensive Plan, *Water Resources Program, Delaware River Basin Compact.

The basic purposes and general methods of operation of the Delaware River Basin Commission are described. Subpart A governs the submission, consideration, and inclusion of all projects, public and private, into the Comprehensive Plan. This Plan includes all projects which the Commission decides are required for the development, planning, conservation, use, management and control of the water resources of the Delaware Basin. Subpart B governs the submission, consideration, and inclusion of these projects into the Water Resources Program which is the annual presentation of the quantity and quality of water resource needs of the area to be served during the next six years or shorter period balanced by existing and proposed projects required to satisfy such needs and a statement of the projects to be undertaken during this period. Subpart C governs the submission and review of projects under Section 3.8 of the Delaware River Basin Compact. Certain projects are designated as having no substantial effect on the water resources of the Basin and are thus not required to be submitted for review. Subpart D defines terms used in this act. (Childs-Fla)
W69-00774

WATER RESOURCES COUNCIL.

18 CFR Ch 6, part 701 and 703 (1968).

Descriptors: *United States, Legislation, *Water Resources Planning Act, *Conservation, Water resources, *River basins, Projects, Navigation, Federal Power Act, Land resources, Grants, States, Irrigation, River Basin Commission.
Identifiers: *Water Resources Council, Secretary of Agriculture.

The Water Resources Council is to carry out the purposes in the Water Resources Planning Act. These purposes are conservation, development, and utilization of water and related land resources. The Council's functions are: (1) to assess the adequacy of water supplies; (2) to study the relation of regional and river basin plans to the requirements of larger regions; (3) to appraise the adequacy of present means of implementing water and related land resources policies; (4) to establish standards for regional or river basin plans; and, (5) to coordinate federal agencies in river basin planning. The Act describes the composition and operating procedures of the Council and provides the methods of administration of grants to states to encourage: (1) state participation in federal-state comprehensive water and related land resources planning; (2) state preparation of plans for use of these resources; (3) state training of personnel to develop planning capability. The Act also provides for compliance with the Civil Rights Act. (Childs-Fla)
W69-00777

AN ACT REORGANIZING AND RENAMING THE RHODE ISLAND WATER RESOURCES COORDINATING BOARD, AND EXTENDING ITS POWERS AND DUTIES.

Rhode Island Laws 1967, Ch 156. 18 p.

Descriptors: *Rhode Island, Legislation, *Administrative agencies, Administration, *Water resources development, Water supply, Regulation, Projects, Reservoirs, Water sources, Cities, *Water permits.

Chapter 46-15 of the general laws is amended in its entirety. A nine-member water resources board is created. The board is empowered to: (1) acquire property and interests therein for reservoirs and facilities to treat and distribute waters contained in such reservoirs; (2) construct reservoirs and facilities; (3) formulate and maintain a long-range guide plan for development of water sources; (4) to provide for cooperation in such development; and (5) to make loans to publicly owned water supply agencies. Board approval is required for any addition or extension of the facilities of municipal water agencies, or diversion of water to another state. Upon an application to the board for a new or additional water supply or source thereof, the board may require of the applicant to make provision for the supply of, and to supply water to, any other area of the state. Board personnel is provided for an authorized to enter any lands to make surveys, and examine books and records. The board is to take the place of the old water resources coordinating board. Board-owned and authorized property is exempted from taxation. The board is authorized to make general rules and regulations. (R. F. Williams-Fla)
W69-00846

ESTUARIES - INVENTORY - STUDY, SENATE REPORT NO 1419.

U S Code Cong and Admin News, Vol 1968, No 10, pp 3658-3679, Sept 20, 1968. 22 p.

Descriptors: *Legislation, *Federal government, Bays, Administrative agencies, *Estuaries, Rivers, Aquatic habitats, Currents (Water), Grants, *Estuarine environment, Gulfs, Inlets (Waterways), Intertidal areas, Saline water fish, Sea water, Wildlife conservation.

The Senate Committee on Commerce reported favorably on a proposed bill to authorize the Secretary of Interior, in cooperation with the states, to conduct an inventory and study of the Nation's estuaries and their natural resources. An estuary is a semienclosed coastal body of water having a free connection with the open sea and within which the sea water is measurably diluted with fresh water derived from land drainage. The purpose of this bill is to provide a means for considering the need to protect, conserve, and restore these estuaries in a manner that adequately and reasonably maintains a balance between the national need for such protec-

tion in the interest of conserving the natural resources and natural beauty and the need to develop these estuaries to further the growth and development of the Nation. The result of this study would be due Jan 30, 1970, at a cost of \$500,000. (R. H. Watson-Fla)
W69-00781

THE ECONOMIC DYNAMICS OF RIVER BASIN DEVELOPMENT,

Idaho Univ., Moscow, Agr Econ Dept.

William E. Folz.

Law and Contemporary Problems, Vol 22, No 2, pp 205-220, Spring 1957. 34 ref.

Descriptors: *River basin development, Economic impact, Water resources development, Columbia river basin, Interstate rivers, *Economic efficiency, Irrigation programs, Water demand, Hydroelectric power, Legislation, Leontief models, Input-output analysis.

An inquiry into the influence of river basin development on economic expansion can, perhaps, best be initiated by a determination of the types of resources that are likely to be created or enhanced by such development and then an evaluation of these resources as dynamic economic prime movers. This article suggests that irrigated agriculture is probably the most certain of the products of river basin development to induce economic expansion, electric power rates very high as a prime mover to economic expansion, and other by-products of river basin development, such as navigation, flood control, and recreation, have only negligible potential for inducing economic expansion. (R. Smith-Fla)
W69-00846

GEOLOGIC FACTORS IN COMMUNITY DEVELOPMENT AT NAPERVILLE, ILLINOIS,

Illinois State Geological Survey.

James E. Hackett.

Environmental Geology Notes, Number 22, June 1968, 16 pp, 4 fig, 11 ref.

Descriptors: Bed rock, Dolomite, Non structural alternatives, Flooding, *Impaired water quality, *Geologic investigations, *Water supply, Ground water, Low flow, Stream flow, Drainage basin.

Identifiers: Naperville (Ill), West Branch DuPage River, Spring brook.

Expansion of the city by incorporation of tracts of land for subdivision and for industrial and commercial use has resulted in expansion of community service facilities for water, sewerage disposal, and storm water drainage control. Because Naperville is surrounded by unurbanized land it will continue to grow, necessitating comprehensive plans to meet future development needs. Information on geology, ground water resources, stream flow, and extent of flooding was gathered and related to various aspects of community development. Certain significant problems become evident: construction in areas subject to flooding and areas of poor drainage; impaired water quality due to the fact that Naperville is at the downstream end of the drainage basin in the county; legal and physical hindrances prevent other sources from being used, water supply must be had from underground sources. Considering these factors recommendations for future planning policies are outlined. (Gargola-Chicago)
W69-00943

INTERGOVERNMENTAL RESPONSIBILITIES FOR WATER SUPPLY AND SEWAGE DISPOSAL IN METROPOLITAN AREAS.

Advisory Comm. on Int. Relations. Report No. A-13, Oct. 1962, 135 p, 5 tab, 72 ref, 2 append.

Descriptors: Economies of scale, Water rates, Political aspects, Water quality control, State jurisdiction, Water allocation, Legislation, *In-

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teragency cooperation, Water resources management, Municipal water supply, Investment, State governments, Federal project policy, Institutional constraints.

Identifiers: Multipurpose vs. single purpose.

Discusses the problems of urban water quality and quantity, regional variations, and the difficulties of balancing and adjusting varying governmental interests. Local water problems of inadequate investment failure of individual systems, and the fragmentation of this public function are examined in detail. Various metropolitan approaches are given; arguments for a comprehensive plan include the economics of scale, equalization of water and sewer rates, and fewer unwise investments. Considered then are the political realities in relation to these approaches; the difficulties of the multi-purpose approach are discussed in comparison with the easily implemented single-purpose plans. The state's role in urban water planning is reviewed in the areas of allocation, regulation, facilitation and development. Continuing on governmental involvement suggestions for the role of the federal government in quality and quantity control are given. It is decided that the problems of water resource management are more governmental than technical; ten suggestions for future developments, with plans to implement them are then given. In conclusion, models for acts - State Water Resources Planning and Coordination Act, and Control of Urban Water Supply and Sewerage Systems are suggested. (Gargola-Chicago)

W69-00944

WATER MANAGEMENT AND URBAN PLANNING,

Lyle E. Craine.

American Journal of Public Health, Vol 51, No 3, March 1961, p 427-33.

Descriptors: Water resource management, Water supply, Project planning, Coordination, Project policy, Urbanization, Water means, Flood damage control, Water use, *Inter-agency coordination, Local governments, Public health.

Identifiers: Resources for the Future Inc., Water supply-demand, Population growth.

Solution to water problems of the future will demand a closer coordination of urban planning and water development. New requirements for planning coordination will develop: (1) increased emphasis upon intensive water management in certain urbanized areas; (2) changes in water-use patterns demanding multipurpose planning approaches; (3) demand for greater local participation in federal water management; and (4) comprehensive approach to flood problems. These are largely the product of the interaction of two factors: (1) the concentration of demand upon local water resources, and (2) the increasing value which the urbanized public attaches to water amenities. Greater involvement of local government in water management and a greater integration of water development and urban planning will be required. (Gargola-Chicago)

W69-00947

CONTROL OF LAND CONTIGUOUS TO FEDERAL RESERVOIRS,

Kansas State Univ., Manhattan, College of Architecture and Design.

Maurice Lee Miller.

Kansas Engineering Experiment Station, Special Report 51, 1964, 9 p, 1 tab.

Descriptors: *Land development, Reservoirs, Recreation, Public benefits, State governments, Project planning, *Inter-agency cooperation, Acquisition, Financing, Coordination, Legal aspects, Local governments.

Identifiers: Kansas.

Demand are increasing for recreational, residential, commercial, and industrial land uses adjacent to reservoirs. The greatest need to promote

good development is adequate land use planning and subdivision control. Although each reservoir situation is different, a generalization can be made that a substantial portion of the waterfront should not be subdivided for residential purposes. Increasing public demand for recreation indicates that a portion of the waterfront and the lake itself should be reserved for these purposes. A summary of reservoir planning activities in sixteen states is given. There is a current trend for state agencies to cooperate more with federal agencies in reservoir pre-construction planning. This tends to promote coordination in providing for adequate land for public access and recreation. Specific agencies in Kansas involved in planning are listed. In summary, twelve major findings are reviewed. (Gargola-Chicago)

W69-00962

WATER SUPPLY AND POLLUTION CONTROL ASPECTS OF URBANIZATION,

Duke University, Department of Civil Engineering.

Edward H. Bryan.

Law and Contemporary Problems, Vol. 11, Oct. 1959, p 176-192, 2 tab, 18 ref.

Descriptors: Water value, Urbanization, Desalination plants, Water desalting, Oxygen requirements, *Pollution abatement, *Water quality control, Waste water treatment, Water reuse, Industrial use, Water consumption, Recirculated water, Water reuse, *Water resource development, Water demand, Water supply, Waste dilution.

Identifiers: Florida, California.

Civil engineers have not been fulfilling their proper role in areas of urban planning and building technology. The very need to consider both water supply and pollution control as a single subject is illustrative of the new fields in which the civil engineer must work. As a background to discussion of this, the hydrologic cycle, industrial water use, and impairment of water quality is discussed. Our needs for water have sharply increased in the past years and promises to continue to increase in the future. There would be no problem in connection with water resources if wastewater could be economically treated to remove all pollutant characteristics. Discussion of pollutants, distillation, recirculation, desalination, air pollution, and oxygen demand of water, and their possible significance in management of water quality is given. The problems of urbanization has created many of the water supply problems we now face. There is a great urgency for development of legal tools with good technical consultation in their conception and enforcement. Reorganization of our political boundaries to permit more effective utilization of regional water resources is imperative if we are to have sufficient water resources to meet the increased urbanization of the future. (Gargola-Chicago)

W69-00963

COMPREHENSIVE RIVER BASIN PLANNING: THE ARKANSAS-WHITE-RED BASINS INTER-AGENCY COMMITTEE EXPERIENCE,

Michigan Univ., Institute of Public Administration.

Robert H. Pealy.

University of Michigan, Ann Arbor, 1959, 71 p, 37 ref.

Descriptors: *River basin planning, *Decision making, Project planning, Project purposes, *Institutional constraints, Administration decisions, Legal aspects, Financing, Secondary benefits, Political aspects, State governments, Interagency coordination, Jurisdiction, Inter-agency commission on water resources, Interstate, *River basin commissions.

Identifiers: Arkansas-White-Red River Basin Inter-Agency Committee, Arkansas River, White River, Red River.

The AWRIAC was formed to prepare a comprehensive plan which was to be fully coordinated among the relevant federal agencies and state

governments. The major effort was directed toward getting member agencies to define comprehensive river basin planning, rather than actually preparing a plan. The Legislative history of the AWRIAC is reviewed and basic organizational and procedural forms defined. State representatives and members from designated federal agencies formed the control group, each member having veto power. This unanimity rule was the source of much difficulty in forming any definite plan. A proviso clause whereby existing structures, projects under construction, projects contemplated for future authorization or construction could not be hindered or delayed as a result of the AWRIAC study was a constraint on the development of an independent program. These obstacles, with difficulties in financing, measurement of secondary benefits determined to a great extent the scope and character of the plan. Although the AWRIAC agreed that a comprehensive plan is one which is fully coordinated with respect to economics and engineering, they did not succeed in making a plan which satisfied these criteria. An analysis of this failure is the main purpose of the report. (Gargola-Chicago)

W69-00964

DETERMINANTS OF PROPERTY VALUE ON ARTIFICIAL LAKES,

Wisconsin Univ., Department of Agricultural Economics.

Elizabeth L. David, and William B. Lord.

Unpublished report, Department of Agricultural Economics, University of Wisconsin, Madison, 1968. 69 p, 22 tab, 12 ref.

Descriptors: *Recreation, *Sampling, Demand, Mathematical model, Regression analysis, *Automatic Interaction Detection, Analysis, Investment.

Identifiers: Economics, *Value, *Artificial lakes.

One method of determining the benefits and costs of recreational uses of water resources is to get some measure of the market evaluation of private access to a water front. This report studied the market value of water front plots on man-made lakes (i.e., artificial lakes). The report found that recreational land is much in demand. Increases in property values means an increasing tax base. Also, increases in amounts of waterfront development means more business for the building trades, suppliers, and local businesses. Significant positive relationships were found between the amount of private shoreline property, good water quality, and higher property values. Other variables were also studied. In choosing among the alternative public investments, the higher property values resulting from variants of the characteristics of the site and the lake should be taken into account. (Grossman-Rutgers)

W69-00968

A MODEL TO ESTIMATE THE ECONOMIC EFFECTS OF WATER-BASED RECREATION PROJECTS IN LOCAL POLITICAL SUBDIVISIONS,

Wisconsin Univ., Madison, Agric. Econ. Dept.

Robert J. Kalter.

Final Rep Water Resour Center 65-005, Summer 1966. 207 p, 27 tab, 59 ref, 13 append. OWRR Project A-007-Wisc.

Descriptors: *Recreation, *Recreational facilities, *Economics, Project planning, Lakes, Streams, Rivers, Decision making, Effect, Bibliographies, *Wisconsin, Mathematical models, *Economic impact.

A study was made of the economic impact of water-based recreational activities on the local community of Walworth County in southeastern Wisconsin. General objectives of the study were to: (1) Provide a method by which the economic effects of state and federal water-based recreation projects on the economies of local political subdivisions can be determined; and (2) Begin empirical testing of the model and to illustrate its potential

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use, in conjunction with subsidiary studies, to facilitate and improve the public decision-making involved in recreational resource development. Conclusions and projections are given.

W69-00969

ALTERNATIVE ECONOMIC RESPONSES TO THE ACID MINE DRAINAGE PROBLEMS IN APPALACHIA,

Ohio State Univ., Columbus.

For primary bibliographic entry see Field 05G.

For abstract, see .

W69-00972

PRELIMINARY ETHNOGRAPHIC STATEMENT OF THE CALAPOOIA RIVER BASIN,

Oregon State Univ., Corvallis.

T.C. Hogg, and R.W. Beard.

Misc Pap, 1968. 34 p, 1 map, 64 ref. OWRR Project A-002-Ore.

Descriptors: *Social aspects, *Rural sociology, *Community development, *Social values, Ecology, Social adjustments, Social change, Social impact, Social needs, Social participation, Bibliographies.

Identifiers: Ethnography.

Interviews were conducted using questionnaires and the 'openended' ethnographic technique. It was concluded that the social organization of the Calapooia both retards and is a prelude to any subsequent resource development. Regions now articulated will have the most difficult adjustment to such growth. Those adhering to a hill tradition will more rapidly acculturate than will those retaining the valley tradition. The basin's ecology is not uniform, and it is economically decentralized and disintegrating. The same factors which operate in the Calapooia plague the underdeveloped regions and countries of the world.

W69-01004

ECONOMICS OF WATER CONSERVATION WITH MONOMOLECULAR FILMS: PART I,

Waterloo, Univ., Ontario, Canada.

For primary bibliographic entry see Field 03B.

For abstract, see .

W69-01017

THE ECONOMIC IMPACT ON SOUTHWESTERN WYOMING OF RECREATIONISTS VISITING FLAMING GORGE RESERVOIR.

Wyoming Univ., Laramie, Wyoming, Agricultural Experiment Station.

Rodney C. Kite, and Willard D. Schutz.

Research Journal 11, Agr. Exp. Stat., University of Wyoming, Aug 1967. 24 p, 12 tab, 5 ref, 2 append.

Descriptors: *Leontief models, *Expenditures, Multiplier effects, *Economic impact.

Identifiers: Economics, *Recreation, *Wyoming.

The economic impact and the multiplier effect of expenditures on the following sectors is analyzed: gasoline service stations, food and beverage, and other retail. A detailed statistical breakdown is given of the origin of the recreationists, if their primary purpose was to visit the reservoir, the primary activity they engaged in while at the reservoir, the number and composition of their party, the length of stay, and the distance travelled. The information was obtained through interviews during June, July, and August of 1965. The impact, both direct and indirect, of expenditures on the economic system in the area was derived by use of the multiplier matrix. The multipliers indicate how much economic activity will be generated in a particular sector of the economy by one dollar of new income. The input-output model, which includes the multiplier matrix, is explained in the appendix. (Grossman-Rutgers)

W69-01061

WATER USES IN THE NORTH PLATTE RIVER BASIN OF WYOMING.

Wyoming Univ., Laramie, Wyoming, Agricultural Experiment Station.

For primary bibliographic entry see Field 06D.

For abstract, see .

W69-01062

ON THE SOCIAL RATE OF DISCOUNT.

Princeton Univ., Princeton, N.J.

William J. Baumol.

Am Econ Rev, Vol 58, No 4, pp 788-802, Sept 1968. 16 ref.

Descriptors: *Resource allocation, *Discount rate, Planning, Return, Investment, Taxes, Risk.

Identifiers: *Social rate of discount, *Opportunity cost, Public investments, Time preference, Externalities.

The opportunity cost criterion for the appropriate rate of discount on government investments is utilized to examine the implications of factors such as risk and taxes for the discount rate. While the opportunity cost of resources drawn from consumers may approximately be the corresponding rate on government bonds, the opportunity cost of resources drawn from the corporate sector is generally considerably higher. Thus a higher discount rate should apply to all resources withdrawn from the corporate sector whether they would have been used by the firms to produce consumers' goods or producers' goods. It is also shown that the law of large numbers approach to risk also makes for a relatively high social discount rate. Finally, it is pointed out that those who advocate low discount rates on grounds of social responsibility overlook present social needs and pay attention to those of the future. They must assume, perhaps implicitly, that the present investments required for purposes such as slum clearance and education have a relatively low priority in comparison with the needs of our descendants (who will almost certainly be substantially wealthier than we are). (Seneca-Rutgers)

W69-01066

THE INTERINDUSTRY WATER CONTENT MATRIX: APPLICATIONS ON A MULTIREGIONAL BASIS.

California Univ., Berkeley.

Everard M. Lofting, and H. Craig Davis.

Water Resources Research, Vol 4, No 4, pp 689-695, August 1968. 25 ref.

Descriptors: Input-output analysis, Regional analysis, Planning.

Identifiers: *Interindustry, *Water content matrix, *Multiregional, Leontief inverse, Technical coefficients, Water use multiplier.

An interindustry or input-output model represents the structural interdependence of a national or regional economy. The inverse matrix of such a model reveals in each cell the amount of a given commodity necessary for the delivery of a unit of output of product to final demand. Usually, such entries are in dollar terms; however, these values can be converted to factor requirements such as man-years of labor or acre-feet of water. Such matrices are then termed 'factor content' matrices. Some of the specific uses of a 'water content' matrix constructed from a multiregional input-output model of western states and a vector of water use coefficients are discussed. Suggestions are made concerning improvement of the present water use data and the applicability of these data to regional water planning. (Seneca-Rutgers)

W69-01067

BROAD HORIZONS IN WATER RESOURCE PLANNING AND INVESTMENT.

Resources for the Future, Washington, D.C.

For primary bibliographic entry see Field 06A.

For abstract, see .

W69-01069

CAN WE SOLVE OUR WATER PROBLEMS,

Resources for the Future, Washington, D.C.

For primary bibliographic entry see Field 06A.

For abstract, see .

W69-01070

WATER QUALITY MANAGEMENT AND THE TIME PROFILE OF BENEFITS AND COSTS,

Water Resources Engineers, Walnut Creek, California.

Denny S. Parker, and James A. Crutchfield.

Water Resources Research, Vol 4, No 2, pp 233-246, April 1968. 9 fig, 2 tab, 6 ref.

Descriptors: *Water quality, *Benefits, *Costs, *Water pollution, Management, Planning, Time, Discount rate, Growth rates.

Identifiers: Long-term benefits, Social cost, Benefit function, Present worth, Present worth of the benefit.

Economists, in evaluating the long-term benefits in public works projects, have traditionally held that long-term benefits will contribute little to the total present worth of the benefits accrued over the life of the project. It is shown, however, that the long-term social cost resulting from projects that cause water pollution cannot be neglected or assumed away in the many practical cases where 'amenity' demands of good water quality in a project's area of influence are significant. (Seneca-Rutgers)

W69-01071

REGIONAL ECONOMIC INTERDEPENDENCIES AND WATER USE.

Resources for the Future, Inc., Washington, D.C.

L. M. Hartman, D. A. Seastone, Allen V. Kneese, and Stephen C. Smith.

Water Research, pp 215-231, Johns Hopkins Press, Baltimore, 1966. 17 p, 4 fig, 2 tab, 10 ref, 1 append.

Descriptors: *Water utilization, *National income, *Water transfer, Welfare, Efficiencies, Unemployment, Timing, Colorado, Region, Input-output analysis, Resources, Homogeneity, Diseconomies of scale, Capital mobility, Labor mobility.

Identifiers: *Interdependencies, Free-market, *Externalities, *Income effects, Immobilities, Sunk-capital, Agricultural multiplier.

This paper analyzes the economic aspects of the physical and economic interdependences associated with water use and identifies those effects which have welfare implications. The analysis suggests procedures which would allow the 'water market' to operate in a more efficient manner. The study indicates that certain income externalities exist in water transfer situations and examines the implications of immobilities and unemployment of water transfers that can change national income. Thus, a basis for policy considerations is provided in the planning context and, also, for judging the efficiency of free-market institutions. Unemployment in a water buying area appears to have potentially greater significance on regional income than immobilities in the water losing sector. The timing of water transfers is an important consideration related to the magnitude of sunk-capital facility immobilities and their effect on efficient transfers. The loss of income and adjustments in the public sector are neglected aspects of this problem. Northern Colorado regional input-output model measures of some of the interdependency income effects are presented. (Seneca-Rutgers)

W69-01072

RECREATION BENEFITS FROM WATER POLLUTION CONTROL,

California Univ., Berkeley, California.

Joe B. Stevens.

Water Resources Research, Vol 2, No 2, pp 167-182, Second Quarter 1966. 3 fig, 2 tab, 25 ref.

Descriptors: Demand, *Recreation, Demand schedule, Sports fishing, *Water quality, *Water pollution control, Water pollution effects, Water

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pollution, Social value, Oregon, Methodology, Benefits.
Identifiers: Yaquina Bay, Human behavioral relationships, Consumers, *Recreational benefits.

A methodology for estimating direct recreational benefits from water pollution control was developed through a model of biological and behavioral relationships involved in sports angling. A biological production function was envisaged between inputs of angling effort and the output, or yield, of fish taken. The marginal product, angling success per unit of effort, was taken to represent the 'quality' of the recreational experience. Water pollution would cause deterioration in dissolved oxygen temperature or toxicity characteristics of water, thus shifting the production function downward and causing reductions in angling success, angling effort, and the recreational value of the fishery. Demand equations and 'success-effort' elasticities were estimated for three estuarial sports fisheries, and the methodology was illustrated by means of an assumed reduction in angling success. The direct recreational benefits were identified as the consumer surplus that would result from the prevention of water pollution. (Seneca-Rutgers) W69-01074

RECREATIONAL BENEFITS OF WATER RESOURCE DEVELOPMENT,
California Univ., Berkeley, California.
Leonard, Merewitz.
Water Resources Research, Vol 2, No 4, pp 625-640, Fourth Quarter 1966. 7 fig, 1 tab, 20 ref.

Descriptors: *Demand schedule, Demand recreation, Regression analysis, Benefits, Statistical methods, Water resource development, Model studies, Missouri, Methodology.
Identifiers: *Recreational benefits, *Consumers' surplus, Attendance prediction model, Lake of the Ozarks, Niangua Arm.

Recreation is a purpose of water resource development that should be considered in project evaluation. A demand curve was simulated for recreation at the Lake of the Ozarks in Niangua Arm County, Missouri. Using distance as a proxy for price, the consumers' surplus implied by the demand curve was measured. Cross-sectional variations in associated costs simulated price variations for recreation, a non-market commodity. The basic data necessary for predicting recreation demand are the county's population, population density, distance from the site, and mean income. Variables such as mobility and the availability of alternative recreational opportunity did not appear to be useful in the forms in which they were available. Some relevant considerations in the design of the sample survey are indicated. (Seneca-Rutgers) W69-01075

RESOURCE ALLOCATION AND THE PUBLIC SECTOR,
Yale Univ., New Haven, Connecticut.
Duncan K. Foley.
Yale Econ Essays, Vol 7, No 1, pp 45-98, Spring 1967. 7 fig, 13 ref.

Descriptors: *Resource allocation, Benefits, *Taxation, Progressive taxes, Tax rate, *Welfare, Political aspects, Social aspects, Government.
Identifiers: *Public goods, Private goods, Preferences, *Equilibrium theory, *Pareto optimality, Utility functions, Proportional taxes.

This essay develops a theory of resource allocation and competitive equilibrium for economies with public goods. Public goods are defined as commodities and services of which every person in a society consumes the total produced. Examples are police protection and defense. Competitive equilibrium is generalized to include a government which is at least minimally responsive to the preferences of citizens. The efficiency prices associated with a Pareto optimum are interpreted to demonstrate the nonexistence of any Pareto op-

timum, and of an unanimously favored alternative tax and expenditure proposal. The existence of an equilibrium with a proportional income or wealth tax is proved. A brief discussion of the problem of interpersonal utility comparisons is presented and an operational definition of equitable allocation is proposed. The political stability of certain common tax structures, including progressive income taxes in a society with majority rule is investigated and an extension of the theory to the existence of local public goods and the problems of regional government is presented. (Seneca-Rutgers) W69-01078

BOND EVALUATION AS A DECISION UNDER CERTAINTY, RISK OR UNCERTAINTY,
Norwegian School of Economics and Business Administration, Norway.
C. M. Schilbred.

The Swedish Jour Econ, Vol 70, No 1, pp 43-56, March 1968. 2 fig.

Descriptors: *Value, Decision making, *Risk, Probability.

Identifiers: *Bonds, *Redemption date, Lottery bond, Series bond, Annuity bond, Option bond.

According to whether a bearer's bond has been issued under the provision that its future redemption is to take place at a fixed date, in one of a series of lotteries, or at the option of the debtor, the investor's valuation of the bond may be described as a decision under certainty. As investors in bonds are internationally and commonly confronted with such decision problems and are aware of the relevant properties, this is a field where empirical studies of the investor's treatment of risk and uncertainty can be undertaken. Some cursory observations of the applied decision rules are analyzed. (Seneca-Rutgers) W69-01079

ON RESERVOIR SITE PRESERVATION POLICY,
Resources for the Future, Washington, D.C.

For primary bibliographic entry see Field 06A.
For abstract, see .
W69-01080

PRIVATE CAPITAL INVESTMENT: A CASE STUDY APPROACH TOWARDS TESTING ALTERNATIVE THEORIES,
Leeds Univ., Great Britain.

C. M. Cannon.
Jour Indus Econ, Vol XVI, No 3, pp 186-195, July 1968.

Descriptors: Diversification, *Investment, Profit, *Capital, Expenditures, *Risks forecasting, Demand.

Identifiers: Liquidity, Expand production, Production process, Factory capacity, *Accelerator theories.

This paper considers information collected and used by four businesses, and their formation of expectations during their appraisal of proposals for four factory investments. The businesses were very large, each with an international reputation. Four large capacity expansion investments were selected for further study out of 14 investments selected by these firms for investigation by the Manchester University Center for Business Research. The case-study evidence was consistent with an absolute sales-capital stock form of accelerator relation, if the subjective character of expectations of market size is admitted. On the other hand, if a marginalist approach admits rigidities in expectations and imperfections in planning and financial control, it will provide a similar prediction to that of an accelerator relation: changes in the ratio of expected absolute sales to capital stock will determine changes in the level of private capital investment. The evidence also suggests that this accelerator relation was abruptly recognized as inadequate by businessmen who were experiencing a downturn in the busi-

ness cycle; only then was attention turned to a financial summary of the worth of expenditure proposals. (Seneca-Rutgers) W69-01081

OPTIMUM INVESTMENT IN STRUCTURAL FLOOD CONTROL,

Rutgers, The State Univ., New Brunswick, New Jersey, Water Resources Research Institute.

William Whipple, Jr.
Journal of the Hydraulics Division, ASCE, Vol 94, No HY6, Proc Paper 6238, pp 1507-1515, November 1968. 9 p, 2 fig, 2 tab, 9 ref.

Descriptors: *Cost-benefit analysis, *Flood control, Flood plain zoning, Flood plains, Flood plain insurance, *Flood damage, Investment.

Identifiers: Structural improvements, Intangible damages, Municipal area, Corps of Engineers, *Project-induced growth, Partial control.

National flood damages have been increasing, despite extensive construction programs, due largely to economic encroachments on the flood plain. This situation calls for a reconsideration of flood control economics. Much of this encroachment occurs as a result of the areas being protected by flood control projects and may be described as project induced. Analysis of project-induced damages indicates that, contrary to certain critics, only quite high degrees of flood protection can be justified economically. As a result of this approach, benefit-cost ratios as usually computed should be reduced. Basin-wide reservoir systems inherently involve extensive partial flood protection, due partly to the extension of effects downstream and partly to the continual economic development in flood plain areas lower than those to which adequate protection is afforded. Therefore, some way must be found to control project-induced growth downstream, as an adjunct of reservoir systems. This could be done by general reservation of floodways downstream of flood control reservoirs. (Seneca-Rutgers) W69-01083

OPTIMAL TAXING OF WATER POLLUTION,
Chicago Univ., Illinois.

For primary bibliographic entry see Field 05G.
For abstract, see .
W69-01084

AN ASPECT OF PROJECT-SELECTION DURABILITY VS. CONSTRUCTION PERIOD,
Peterhouse College, Cambridge Univ., Great Britain.

Amit Bhaduri.
Econ Jour, Vol LXXVIII, No 310, pp 344-348, June 1968. 1 fig.

Descriptors: *Durability, Capital, Investment.

Identifiers: *Construction period, *Gestation lags, Time rate of discount, Fixed assets, Capital-output ratios.

The question is examined of balancing the economic 'advantage' of longer durability against the 'disadvantage' of longer construction-period in selecting among alternative projects producing a given commodity. Assuming that the time-path of the investment-fund to be allotted for installing projects is known and also, that time-path of investment is rising at a steady percentage rate over time, the paper establishes the following result: a faster-growing economy may find it more advantageous (other things being equal) to install projects of shorter durability and shorter construction-period. The main point of the paper is to indicate how choices involving time in project evaluation can be settled through the assumed rate of growth of investment, rather than the hazy and less operational notion of a 'social rate of time-discount.' (Seneca-Rutgers) W69-01085

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TAX AND INCOME STABILIZATION,
Trinity College and Institute of Public Administration,
Dublin, Ireland.
J. A. Bristow.
Econ Jour, Vol LXXVIII, No 310, pp 299-311,
June 1968. 1 fig.

Descriptors: *Stabilization, Investment, Consumptive use, *Tax rate.

Identifiers: *Cyclical fluctuations, *Policy lag, Revenue, Dividends, Income tax, Indirect taxes, Marginal propensity to consume.

An attempt was made to assess the effects on cyclical variations in the rate of income growth in the United Kingdom (1955-1964) of one component of stabilization policy-tax changes. First a quantitative model was constructed. This model was to show the effects of various types of tax change, on a quarterly basis. The effects of all tax changes 1955-64 were estimated, and these effects were deducted from the actual quarterly outcome of four variables—Gross Domestic Product, total expenditure, consumption, and gross investment. This gave an estimate of what would have occurred if there had been no tax changes. The result was increased stability, providing some support for the view that tax changes are usually made too late to be ideal anticyclical measures. (Seneca-Rutgers)
W69-01086

EXTERNAL ECONOMIES AND SECOND-ORDER OPTIMALITY CONDITIONS,
Princeton Univ., Princeton, New Jersey.
William J. Baumol.

American Econ Rev, Vol LIV, No 4, part 1, pp 358-372, June 1964. 2 fig, 7 ref, 3 append.

Descriptors: *Optimization, Return to scale.

Identifiers: Social welfare function, Corner points, *External economies, Social cost, *Second order conditions, *Public policy.

The following propositions are demonstrated and explained: (1) an industry characterized by external diseconomies may produce an output less than the social optimum even if the economy is in competitive equilibrium and all other industries yield external economies. (2) There is no general validity to the neoclassical proposition which alleges that external benefit yielding activities will be below the optimal level. (3) The presence of externalities is likely to lead to multiple maxima in the social welfare function and to violation of the second order maximum conditions. (4) The neoclassical position referred to in (1) and (2) above is likely to fail because we may move toward a local optimum by increasing output when marginal social benefit exceeds marginal social cost. (5) Even if the second order conditions hold, the neoclassical proposition is still invalid except where marginal social costs and benefits are exactly equal for all activities but one. (6) Policy prescription is more complicated and its conclusions more ambiguous than previously thought. It is only known that some activity yields external benefits (or diseconomies) of unspecified magnitude, from this alone it is impossible to determine whether the activity should be expanded or contracted. (Seneca-Rutgers)
W69-01087

IS PUBLIC INTERVENTION IN WATER RESOURCES DEVELOPMENT CONDUCIVE TO ECONOMIC EFFICIENCY,
Resources for the Future, Inc., Washington, D. C.
John V. Krutilla.

Natural Resources Jour, Vol 6, No 1, pp 60-75, January 1966. 1 tab.

Descriptors: *Efficiencies, *Welfare, *Water resources development, Institutions, Prices, Marginal costs, *Cost-benefit analysis, *Water management.

Identifiers: *Public intervention, Indivisibilities, Marginal social product, Marginal social cost, Coupon rates, *Reimbursement policy.

Observations on the institutional machinery of public intervention at the present time merit serious consideration when the question is posed with respect to the sufficiency of public intervention for the improvement of efficiency in the water resource development field. A concerted effort should now be made to review the character and capabilities of existing agencies, to identify barriers to improved performance, and to address the problem of organizing a capability consonant with present and future requirements. Not a little could be learned from the pioneering work in water quality management by the cooperative water quality management associations in the Ruhr, or the integration of investment planning, design criteria and pricing policy of Electricité de France. Doubtless a similar spirit of innovation in the water resources field in the United States would add a considerable measure of assurance that public intervention would be sufficient as well as necessary to improvement of efficiency in water resources development programs. (Seneca-Rutgers)
W69-01088

ISOLATION, ASSURANCE AND THE SOCIAL RATE OF DISCOUNT,

Delhi Univ., India, Delhi School of Economics.

Amartya K. Sen.

Quart Jour Econ, Vol LXXXI, No 1, pp 112-124, February 1967.

Descriptors: Consumptive use, Time, Return.

Identifiers: Zero-sum game, *Social rate of discount, Optimum savings, Social contract, *Isolation paradox, *Assurance problem.

Recent discussions on the relationship between private and social rates of discount have been concerned with a special application of a very general problem, this being a N-person extension of the 2 person non-zero sum game of the 'Prisoners' Dilemma.' In the first section the nature of this general problem (the isolation paradox) is studied. In the remaining three sections the application of this general framework to the question of optimum savings and the social rate of discount is examined. In particular, Lind's criticism of Marglin's analysis of the divergence between the social and private rates of discount is examined. Finally, the question of the future generation being much richer (on the average) than the present generation is studied as a ground for an objection that has been raised in the literature against chances of the occurrence of the 'isolation paradox.' It is shown that a change in the average wealth of the future generation vis-a-vis that of the present generation leaves the possibility of the 'isolation paradox' completely unchanged. (Seneca-Rutgers)
W69-01089

CONVENTION AND LIMITATION IN BENEFIT-COST ANALYSIS,

Stanford Univ., Stanford, California. Food Research Institute.

Richard J. Hammond.

Natural Resources Jour, Vol 6, No 2, pp 195-222, April, 1966.

Descriptors: Prices, *Cost-benefit ratio, *Cost repayment.

Identifiers: Bureau of Reclamation, Infallibility, Secondary benefits, Market, Maximization.

Official doctrine on benefit-cost analysis presents contradictions of principle and mistakenly neglects administrative considerations. The contradictions appear to be due to misunderstanding of the role of theory in economic questions, whereby statements of principle having no relation to empirical fact are treated as maxims of conduct, and theorems based on the assumption of perfect foresight are applied in a world where the future is inherently uncertain. Critics of present governmental practice habitually argue for a greater recourse to benefit-cost analysis in the name of efficiency. They forget that economics cannot go beyond defining efficiency to ensuring it. On the contrary: the question is rather

whether the analysis is not being overdone, in the belief that it can somehow dispense with the need for political and administrative decisions. What is needed is a candid recognition of its inherent limitations: that it cannot forecast the future and is incapable, by reason of its dependence on policy assumptions, of becoming the basis of policy decisions. It is a useful administrative tool in limited applications, not a solvent for major economic problems in the field of resource use. (Seneca-Rutgers)
W69-01091

CONCLUSIONS ABOUT WATER SUPPLY,

Rand Corporation, Santa Monica, California.

Jack Hirshleifer, James C. DeHaven, and Jerome W. Millman.

Water Supply Economics, Technology and Policy, Univ. of Chicago Press, 1963, pp 357-367.

Descriptors: Water supply, Technology, *Administrative decisions, Investment, Pricing, Welfare, Attitudes, Social values, Market, Adoption of practices, Water law, Economic evaluation, Institutional constraints, Political aspects, Attitudes, Federal governments, State governments, Local governments.

Identifiers: Decentralized decision making, Alternatives.

The economics, technology and policy of water supply are examined. The major purpose was to show by argument and example that the correct application of economic principles will produce the greatest efficiency in water supply procurement and utilization in relation to and in competition with all other desires of the community. In this country major water investments are typically prematurely undertaken, resulting in overinvestment in water supply. Reasons for this are discussed. Decentralized decision making is the preferred manner, with private, local, state and federal decision making ranked in that order. Much of the present misuse of water within the sphere governed by the market can be traced to imperfections in water law and its administration. Suggestions for improvement are given. The importance is stressed of considering a wide range of planning alternatives. Significant new developments in technology are also reviewed. In conclusion the 'water is different' philosophy is criticized and water resources are shown to be an economic resource similar to land and should be treated economically, and politically in the same manner. (Gargola-Chicago)
W69-01095

WATERSHED DEVELOPMENT IN THE COMMUNITY FIELD,

Mississippi State Univ., Water Research Institute; Social Science Research Center, State College, Mississippi.

Kenneth P. Wilkinson.

Rep, Mississippi State Univ, 1968, 11 p, 14 ref.

Descriptors: *Watershed development, Community development, Social aspects, Sociology, Social impact, Social change, *Social participation, Water resources development, Social needs, Social values, Social behavior, Local governments, *Planning, Social function.

Identifiers: Dynamic field, Field theory.

The paper is concerned with the interaction between local and extralocal social structures and processes using watershed development as an area of investigation. The stated objective of the paper is to provide both a logical and empirical basis for the development of hypotheses action. The framework developed would be applicable to urban and other local contexts, including metropolitan areas. Community is viewed in terms of social field theory. The community field is characterized by actors, associations and activities, and has a distinct direction or focus. Distinction is made between societies according to the degree of coordination or integration among interest field and among the interest fields within a given local society. Hypotheses are

advanced relating levels of task accomplishment and four types of community-agency fields: internally consistent fields; coordination action style; internally inconsistent fields; and autonomous action style. Two empirical community studies are reviewed and interpreted in light of the hypotheses. (Abodeely-Chicago)
W69-01096

MUNICIPAL WATER SUPPLY,
Rand Corporation, Santa Monica, California.
Jack Hirshleifer, James C. DeHaven, and Jerome W. Millman.
Water Supply, Economics, Technology and Policy, Univ. of Chicago Press, 1963, pp 175-181, 2 tab, 7 ref.

Descriptors: *Municipal water supply, Costs, Evaluation, Wastewater treatment, *Water distribution, Water consumption, Project planning, Optimum development plans, Interest rates, Sewerage systems, Water transfer, Unit costs.
Identifiers: Economic constraints.

General characteristics of municipal water supply systems are: (1) sources of raw water, (2) transmission system, (3) treatment facilities, (4) distribution network, (5) pumps and storage capacity, (6) valves, hydrants, and meters to control and measure flow. The total cost of the municipal water system lies in three major areas: (1) production, transmission, and treatment costs; (2) distribution costs; and (3) fire protection. Investment and operating costs differ from city to city. Water treatment costs are discussed in relation to capacity and interest rates. The choice of a transport system is influenced by terrain features, total capacity, length of the system, and the relative costs of the alternative types of elements and of pumping. No generalized cost information has been developed relating to large water transmission systems but a discussion of specific cost factors is given. The economic considerations of consumptive losses in public systems are reviewed and alternatives for improvement suggested. (Gargola-Chicago)
W69-01097

HUMAN RESOURCES AND REGIONAL DEVELOPMENT: SOME LESSONS FROM FRENCH EXPERIENCE,
Kentucky Univ., Lexington.
Niles M. Hansen.
Southern Economic Journal, Vol 34, No 1, pp 123-132, July 1967. 1 tab.

Descriptors: *Human resources, Migration, Education, Training, Land development, Economics.
Identifiers: France, *Regional development.

The underdevelopment of France's agricultural regions of the West has been attributed to the attractiveness of the Paris region and to the need for land reform and larger farms in the West. Although these factors are important, a more fundamental problem is the lack of investment in the quality of human effort. While trying to maintain a large population in the lagging agricultural regions, French policy in past years has neglected human resource investment. In recent years more emphasis has been placed upon human resource investment, but this emphasis has not been strong enough. Both theoretical propositions developed previously by the author and the data considered in the article support, by opportunity cost criteria, the case for emphasizing human resource development. (Seneca-Rutgers)
W69-01099

WEALTH AND INCOME DISTRIBUTION, INVESTMENT, AND ECONOMIC DEVELOPMENT,
Wayne State Univ., Detroit.
Hector Correa.
Southern Econ Jour, Vol XXXIV, No 2, pp 283-285, October 1967.

Descriptors: Capital, Credit, *Investment, Profit, *Financing.
Identifiers: Leisure, Capital intensive, *Income distribution, *Concentration of wealth, Management, *Economic development.

This paper attempts to show how a high concentration of wealth and income influences the behavior of savers and investors and, therefore, economic growth. The relationships presented are to be considered as a hypothesis, which could be validated by empirical research. However, there is at present a lack of available data. As a substitute it is shown that several characteristics of the developing countries in which conditions of high concentration of income are assumed to exist can be considered logical consequences of the hypotheses presented. (Seneca-Rutgers)
W69-01103

CRITERIA FOR PUBLIC INVESTMENT: SOME SIMPLIFYING SUGGESTIONS,
London School of Economics, Great Britain.
E. J. Mishan.

Jour Pol Econ, Vol 75, No 2, pp 139-146, April 1967. 1 fig, 8 ref.

Descriptors: *Interest rate, *Discount rate, *Investment, Financing, *Benefits, Constraints.

Identifiers: Social opportunity cost, Opportunity yield, Social rate of time preference, Present value, Perpetuity, Market yield.

An appropriate public investment criterion, under conditions of certainty, requires that the present value of an investment project exceed its social opportunity cost. Recently three features have been built into such models, each of which, within a full employment framework in which the social rate of time preference exceeds the market yield, can be shown to be invalid: (1) a distinction between debt finance and tax finance, (2) discounting future returns at the social rate of time preference as a necessary requirement, and (3) reinvestment of some fixed proportion of the primary, secondary, and subsequent stream of returns at the market opportunity yield. The criterion is simplified by a correct allocative approach. In the particular case where all benefits are revenues the public investment criterion is met if the present value of the stream of benefits and outlays is positive--when discounted at the existing market opportunity yield and not the social rate of time preference. (Seneca-Rutgers)
W69-01104

RESTRAINTS AND THE ALLOCATION OF RESOURCES,

Kent Univ., Canterbury, Great Britain.

Charles Kennedy.

Oxford Econ Papers, Vol 20, No 2, pp 195-207, July 1968. 2 fig, 16 ref.

Descriptors: Investment, Expenditures, Financing, *Resource allocation, Constraint, Growth rates, *Import.

Identifiers: *Saving, Scarcity, *Underdeveloped countries, *Foreign exchange, Numeraire, Production function, *Substitution.

The Keynesian proposition that saving is not a resource is valid not merely for the case of underutilized resources. Its general application arises from the negative character of saving. A simple version of the theory of dominant restraint holds that there may be two possible restraints on the growth of output but that only one will be operative at any one time. The objection to this theory is that it unrealistically presupposes a complete lack of substitutability between imports and capital. The possibility of substitution between imports and capital enhances the importance of foreign borrowing in facilitating economic growth, and makes any treatment of saving as a quasi-resource illegitimate. The treatment of saving as a numeraire for valuing other resources is also criticized, for most countries foreign exchange would be more appropriate.

While the necessity to consider more than one scarce resource has already been proved, it is suggested that a developing country would do better by using a crude 'foreign exchange' criterion than by using a more sophisticated approach that included saving (capital) as one of the resources. (Seneca-Rutgers)
W69-01106

WELFARE MAXIMIZATION: THE SIMPLE ANALYTICS WITH PUBLIC GOODS,
Rice Univ., Houston, Texas.

Charles E. McLure, Jr.

Canadian Jour Econ, Vol 1, No 3, pp 633-639, August 1968. 2 fig.

Descriptors: *Resource allocation, Alternative costs, *Optimization.

Identifiers: *Pareto optimality, Jointness in supply, Conflict curve, *Public good, Income redistribution, *Social welfare function.

This note attempts to demonstrate how public goods can be incorporated in the analysis of welfare maximization. One major change is made in the marginal conditions for Pareto optimality when a public good is introduced. The box diagram and conflict curve are considerably altered, the marginal conditions for over-all efficiency become equality of the marginal rate of transformation and the sum of the marginal rates of substitution for the two individuals, and there are no marginal conditions for efficiency in exchange. This is a crucial difference. Voluntary exchange does not occur since each person realizes that his consumption of the public good is largely independent of his contribution to its provision. Because of the impossibility of trade in the public good, the market does not assure that the optimal amount of the public good is produced and the 'invisible hand' fails to achieve even the marginal conditions necessary to maximize social welfare. (Seneca-Rutgers)
W69-01107

OPTIMAL ECONOMIC GROWTH AND DISTRIBUTION AND THE SOCIAL UTILITY FUNCTION,

McGill Univ., Montreal, Canada.

A. Asimakopoulos.

Canadian Jour Econ, Vol 1, No 3, pp 540-550, August 1968.

Descriptors: *Optimization, Population, Marginal productivity.

Identifiers: Biological interest rate, *Intertemporal allocation, Social welfare function, *Growth path, *Intergeneration distribution.

The choice of social utility functions for inter-generation distribution and intertemporal allocation should be made after examination of the results of their application. The Lerner-type function which takes into account group size was preferred for the first purpose, but a function which makes no allowance for population size should be used for the second purpose if fairness to all is a criterion of policy. This function can, however, display positive time preference. These two social utility functions are not inconsistent; they are constructed to deal with different tasks and can both be used by the same planning board. The justification for using a Lerner-type social utility function for intergeneration distribution is not that it gives the same results as the hedonistic function described in the article, but that it prevents discrimination between individuals in different generations which is inconsistent with individual preferences and production conditions. Lerner judges this result to be fair to all individuals in the circumstances of the particular problem. Samuelson's optimum overcompensates for the discrimination over time, that it is purportedly trying to avoid, by giving a consumption bonus to the individuals living close to the terminal period of the plan. (Seneca-Rutgers)
W69-01108

Field 06—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

THE EVOLVING ROLE OF THE HYDROLOGIST IN WATER RESOURCE DEVELOPMENT.

Utah State Univ, Logan.

Dean F. Peterson.

Proc Int'l Symp Hydrol, Fort Collins, Colo, pp 38-45, Sept 1967. 8 p, 1 ref. OWRR Project A-999-Utah.

Descriptors: Conferences, Water resources, Water pollution control, *Water resources development, Social aspects, Water conservation, *Hydrology, Hydraulics.

This is the welcome address to the International Symposium on Hydrology, Fort Collins, Colorado, Sept 6, 1967. The scope and objectives of the symposium are outlined. The relation between hydraulics and hydrology is discussed. Water resource development is a social process and must be based primarily on social objectives rather than on technological or engineering opportunities.

W69-01117

WATER RESOURCES PLANNING STUDIES OKLAHOMA AND ARKANSAS.

Oklahoma State Univ, Stillwater.

A. F. Gaudy, Jr.

Water Resour Planning Studies, Prog Rep, Oklahoma State Univ, Feb 1968. 20 p, 5 fig, 5 tab. OWRR Project B-006-Oklahoma.

Descriptors: *Water resources, Planning, Water allocation (Policy), Long-term planning, Coordination, Water rights, Water utilization, *Water supply, *Equitable apportionment, *Interstate compacts, Oklahoma, Arkansas.

Identifiers: *Arkansas River.

A study is in progress to assess the water resource available in that portion of the Arkansas Basin in northeastern Oklahoma. The study involves evaluation of five sub-basins (Spavinaw Creek, Illinois River, Lee Creek, Poteau River, and the Arkansas River) with respect to flood and drought flows. One of the aims of the work is to provide accurate estimates of the quantity of water available in these sub-basins for use by agencies of the states of Oklahoma and Arkansas in apportioning the joint water resources in accordance with available conservation storage. In the present report, the Poteau River Basin and the main stream of the Arkansas River are considered. Floods occurring in the entire study area were studied for magnitude and frequency with special emphasis on the problems created due to the short period of available record. For low flow analysis, a Markov Chain Model was applied to render the area hydrologically stable, preserving the essential statistical characteristics of the record, and the results obtained using this model are advocated as the basis for conservation storage. Available information pertaining to water quality, coupled with the water quantity analysis, will provide useful knowledge for further development and regional planning with respect to the water resource.

W69-01140

AGRICULTURAL RESOURCES RELATED TO WATER DEVELOPMENT IN TEXAS,

Texas Agricultural and Mechanical Univ, College Station.

For primary bibliographic entry see Field 03F.

For abstract, see.

W69-01143

THE HUMAN FACTOR AND CHANGES IN WATER USAGE PATTERNS,

Utah State Univ, Logan.

H. Bruce Byland.

Water Resour Res, Vol 2, No 3, pp 365-369, Third Quart, 1966. 5 p, 8 ref. OWRR Project A-001-UTAH.

Descriptors: *Water utilization, Economics, *Social change, Social needs, *Psychological aspects, Social aspects, *Attitudes, Decision making, Laws, Civil engineering, Economic impact, Utah, Water

resources development, Economic justification, Project planning.

Identifiers: Human relations, Bear River Project.

This paper reports on preliminary work of a study dealing with cultural, social organizational, and social-psychological factors associated with a proposed change in water usage patterns. Moves and counter moves related to opposition to a proposed Bureau of Reclamation development on the Bear River in Utah, are used as a focal point. Results manifest the expected opposition: general opposition to change at a covert emotional level, more reasoned opposition by individuals and groups with a vested interest (economic, political, and social) and apparent tactics of vested interest groups to sway public opinion. Opposition to the project developed, was organized and operating 19 months before a committee was organized to promote the project. There were over 1-1/2 times as many articles in newspapers against the project as there were articles on factual information and those that were for the project. Conclusions were that more research in the human aspects of water use and organization for social engineering to augment civil engineers are imperative if our water resources are to be adequately developed.

W69-01144

MULTIDISCIPLINARY RESEARCH AS AN AID TO PUBLIC POLICY FORMATION,

Virginia Polytechnic Institute, Blacksburg.

Jabbar K. Sherwani, Emil J. Gumbel, and Robert V. Thomann.

Water Resour Res Center, Blacksburg, Dec 1965. 68 p, 7 fig, 2 tab, 18 ref. OWRR Project A-999-VA.

Descriptors: Optimum development plans, Decision making, Economic efficiency, Social impact, Systems analysis, Hydrology, Estuarine environment, *Water resources, *Water pollution, *Water policy.

Purpose of the seminar was to stimulate interest in multidisciplinary research in water resources, especially among disciplines traditionally inactive in the field, by showing the increasing number of research opportunities and needs in water resources. Four papers were presented during the seminar: 'Optimal Water Use - A Multidisciplinary Approach,' by Jabbar K. Sherwani; 'Survey of the Theory of Extremes as Applied to Hydrology,' by Emil J. Gumbel; 'Estuarine Water Pollution Control Via Systems Analysis,' by Robert V. Thomann; and 'Multidisciplinary Research on an Estuarine Engineering Project,' by William J. Hargis, Jr.

W69-01148

WATER RESOURCES PROGRAMS IN VIRGINIA,

Virginia Polytechnic Institute, Blacksburg.

William R. Walker.

Water Resour Res Center, Bull 4, Oct 1966. 235 p, 8 fig. OWRR Project A-999-VA.

Descriptors: Water pollution, Water quality control, Recreation, Drainage engineering, Erosion control, Decision making, Runoff, *Water resources, *Virginia, Forecasting, Industrial wastes, Industrial water, Streamflow forecasting.

A symposium on Water Resources Programs in Virginia brought together representatives of various agencies, commissions, and citizens groups who were involved in the planning and executing of water-related activities in the Commonwealth. Purpose of the seminar was to investigate past and present programs of these agencies and groups in order that future planning might be better coordinated, duplication of effort minimized, and freer exchange of ideas fostered. Reports were presented by federal and state agencies and local groups including the U. S. Army Corps of Engineers, Virginia State Water Control Board, Virginia Department of Health, Cooperative Extension Service, Virginia Soil and Water Conservation Commission, Commission on Outdoor Recreation, Roanoke

River Basin Association, James River Basin Association, Interstate Commission on the Potomac River Basin, Tennessee Valley Authority, Department of Health, Education, and Welfare, U. S. Geological Survey, and Virginia Institute of Marine Science. (W. R. Walker-Va Tech)

W69-01149

COMPREHENSIVE RIVER BASIN PLANNING: THE LOWER MEKONG EXPERIENCE,

Wisconsin Univ, Madison.

W. R. Derrick Sewell.

Rep, Water Resour Center, June 1966. 26 p, 4 fig, 4 tab, 26 ref. OWRR Project A-999-WIS.

Descriptors: *River basins, *River basin development, *Water resources development, Project planning, United nations, Foreign countries, Water utilization, Foreign projects, Irrigation, Planning. Identifiers: Mekong Delta, Mekong River Project.

Despite political chaos, the Lower Mekong is the first successful application of a comprehensive approach to development of an international river. It is the first instance of direct UN sponsorship of planning and development of an international river on a continuous basis, and is an outstanding example of international cooperation in scientific investigations, planning and development. The most important lesson of the Mekong experience, is that water resources planning can be an effective device for overcoming political tensions. The Mekong Committee has survived despite the political turmoil of the region. The signing of an agreement for international exchange of electric power emphasizes the sense of common purpose which water resources planning can engender.

W69-01157

POPULATION TRENDS FOR THE PLATTE AND GREEN RIVER BASINS IN WYOMING: 1890-2010,

Wyoming Univ, Laramie.

Raymond K. Kenney, and John W. Birch.

Wyo Water Resour Res Inst, Water Resour Ser 4, July 1967. 41 p, 4 fig, 7 tab, 22 ref. OWRR Project A-001-WYO.

Descriptors: *Water requirements, Forecasting, Statistical methods, Water utilization, Municipal water, *Population, *Population growth, Bibliographies, Census, Future planning, Statistics, Domestic water, *Human population, Community development, Wyoming.

Identifiers: Platte River Basin (Wyo), Green River Basin (Wyo).

Long-term population growth forecasts are made for the Green and Platte River Basins, Wyoming. Projections are made for 5-yr intervals, by counties, for 1970 to 2010. Time series census data, adjusted for county boundary changes, provided the empirical base for the projections. Projections for the entire basins were derived by summation of separate counties and from summation of population data for the entire basin. These projections will serve as a basis for estimating future residential water requirements.

W69-01158

THE 1960 CALIFORNIA WATER BOND ISSUE AND THE LOS ANGELES COUNTY ELECTRORATE: A STATISTICAL AND HISTORICAL ANALYSIS,

California Univ, Los Angeles.

Dwaine Marwick.

Water Resour Center, Tech Completion Rep, Nov 1967. 117 p, 14 tab, 172 ref. OWRR Project B-013-CAL.

Descriptors: *Water resources development, *California, Planning, *Analysis, Coordination, Legislation, Feasibility, *Financing, Government financing.

Identifiers: Los Angeles County (Calif.).

Cost Allocation, Cost Sharing, Pricing/Repayment—Group 6C

In 1960 a water bond referendum on the Nov ballot in Calif was approved by a slim majority. This confirmed the vast construction program authorized by the 1959 state legislature; the voters had approved the issuance of 1-3/4 billion dollars in general obligation bonds of the State of Calif. This amount was enough to complete at least one major project and enough to commit Calif to a coordinated and systematic plan for developing statewide water resources. Los Angeles county carried the day; its voters approved Proposition 1 by 56% of the votes cast. Without this margin of support from the State's largest metropolis, the water bond referendum would not have passed. Viewed from the perspective of 1967, it is desirable to clarify the sociological and political correlates of public awareness of, interest in, and willingness to support the large outlays of public funds needed for the maintenance of an adequate water supply for Los Angeles county. Such clarification is possible by appropriate statistical analysis of the electoral and demographic data for 1960 available for each of the 1297 census tracts of Los Angeles county.

W69-01161

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

AN ACT TO REGULATE WATER COMPANIES AND THE SALE AND DISTRIBUTION OF WATER WITHIN THE STATE.

Michigan Acts 1967. Act No 19, 4 p.

Descriptors: *Michigan, Legislation, Water distribution, Water conveyance, Water costs, *Administrative agencies, Water users, Water demand, Waterworks, *Water rates, *Utilities.

Michigan places the regulation of all private water companies in the control of the public service commission. All extensions or discontinuances of service must be authorized by the commission. The commission must approve all present rates and any future changes in rates. The burden of proof is on the water companies to show that their rates or proposed rates are reasonable. The commission polices the water companies to insure that their service is good and no favoritism is shown to any customers. The commission is authorized to investigate and hold hearings on any complaints received or on its own motion. Any water company dissatisfied with the judgment of the commission may appeal to the circuit court. Upon trial of the action, no new evidence may be introduced until first submitted to the commission for reconsideration of the finding. The burden of proof is on the complainant to show by clear and satisfactory evidence that the order of the commission is unlawful or unreasonable. (R. H. Watson-Fla)

W69-00779

SCOZZAFAVA V US (GOVERNMENT USE OF STREAM BEDS).

199 F Supp 43-46 (D C N Y 1961).

Descriptors: *Ownership of beds, Navigable waters, *River beds, Eminent domain, Water law, Legal aspects, Federal government, Navigation. Identifiers: Dominant servitude.

The question is whether the owner of the river bed of a navigable stream may demand rent from the United States for the storage of the latter's deactivated vessels in the stream. The court noted that the title of the owner of fast land on the shore of a navigable waterway is subordinate to the public right of navigation and the power of Congress over the improvement of navigable rivers. Lands below the high water mark are subject to a dominant servitude in the interest of navigation. The deciding issue is whether the government's acts are in aid of navigation thereby freeing the government from a duty of compensation. The court held the question to be one of fact and not to be decided on a motion to dismiss. (Horner-Fla)

W69-00876

PRELIMINARY DESIGN AND SIMULATION OF CONVENTIONAL WASTEWATER RENOVATION SYSTEMS USING THE DIGITAL COMPUTER,

Federal Water Pollution Control Administration, Cincinnati, Ohio.

Robert Smith.

Water Pollut Contr Res Ser Publication No WP-20-9, 64 p, March 1968. 34 fig, 2 tab, 71 ref, 1 append.

Descriptors: *Waste water treatment, *Cost analysis, *Digital computers, *Computer programs, *Computer models, Research and development, Design, Sanitary engineering.

Identifiers: *FORTRAN program, Renovation systems.

A digital computer method and a FORTRAN IV Program listing, used to bring together previously separate calculations for cost and performance of the individual processes waste water treatment systems into one computation for an entire system, are presented with a thorough review and discussion of the subject. This program makes it possible with a fair degree of reliability to compute the capital cost, amortization or debt service cost, and operating and maintenance cost of the entire plant or of individual processes or groups of processes, as a function of independent design parameters. The parameters are plant design capacity, influent stream, fraction of suspended solids removed in the primary settler, mixed liquor suspended solids held in the aerator, demand BOD of plant effluent, and detention time for the digester. Results of computations are shown in tables and graphs. The program was slanted toward preliminary design rather than operation simulation, but the difference is not fundamental because only steady state performance is considered. (Knapp-USGS)

W69-00926

THE LEVEL OF DEVELOPMENT OF WATER RESOURCES,

Joe S. Bain, Richard E. Caves, and Julius Margolis.

In Northern California's Water Industry, Resources for the Future, Wash., D. C., 1966, Chap 15, pp 529-554, 8 ref, 3 tab.

Descriptors: Annual rates, Water resource development, *Methodology, *Water use, Marginal costs, Rate of return, Benefit-cost ratio, Pricing, Marginal benefits, Average costs, Water values, Market value, Administrative decisions, Electric power costs, Marginal productivity.

Identifiers: Sacramento Valley, Northern California, Central Valley, *Water usage development, Water facilities development.

An analysis of the performance of the water industry in Northern California is discussed under the three broad headings of (1) level of development, (2) sequence of development, and (3) rationality of development. Two definitions of the level of development include, (1) level of water facilities development, ie., the quantity of non-water resources going to make water available for use, and (2) 'water usage development,' which is defined at length. The rationality of development is appraised through evaluation of present water allocation among users, uses, sites, and time. Measurement of the above factors is considered in situations of water scarcity and plenty. As standards of measurement, marginal values, rates of return, and benefit-cost ratios are considered. Evaluation of local public water agencies is done through deductive inferences and inductive measures of performance. Statistical evidence on the level of development of these local agencies is through analysis of rates of return, and relation of long-run marginal costs to marginal values. In a similar, but brief, manner, the level of development and behavior of large wholesale agencies is also considered. (Gargola-Chicago)

W69-00948

THE INVESTMENT DECISION,

Resources for the Future, Washington, D. C.

Joe S. Bain, Richard E. Caves, and Julius Margolis.

In Northern California's Water Industry, Chap 11, 1966, p 363-79, 1 tab, 19 ref.

Descriptors: *Water supply, Water demand, Discount rate, Decision making, Intangible benefits, *Evaluation, Water rates, Discriminatory pricing, Municipal water supply, Evaluation, Water resource planning, Water users, Water values, Financial feasibility, Financing, Capital investment, *Investment, Water law, *Institutional constraints.

Identifiers: San Francisco Bay Area, Uncertainty, East Bay Municipal Utility District.

Important environmental forces affecting investment decisions in the San Francisco Bay area are (1) rivalry of agricultural uses, and (2) multiplicity of governments. In light of these factors the internal decision making and investment criteria of urban agencies is considered. Some of the requirements for agency investment are: (1) prompt arrival of supply, (2) capital outlays financed by revenues, (3) adequate supply to meet long-term needs, (4) high quality water, (5) minimization of cost. Evaluation of benefits is rarely considered, due to difficulties in their assessment, so minimization of cost is the only real economic consideration. The discount rate, treatment of uncertainty, and adjustment for future price changes is discussed, and possible sources of error in the use of the factors are considered. Performance uncertainties created by external forces bearing on water investments are demonstrated by examples of urban water agency experiences in the bay area. (Gargola-Chicago)

W69-00951

MUNICIPAL WATER RATES,

Rand Corporation, Santa Monica, California.

Jack Hirshleifer, James C. DeHaven, and Jerome W. Millman.

Water Supply, Economics, Technology, and Policy, 1960, p 87-112, 4 fig, 2 tab.

Descriptors: Discriminatory pricing, Water allocation, *Municipal water supply, Average costs, Marginal costs, Average prices, *Economic evaluation, Optimum development plans, Economic efficiency, Market value, *Water rates, Water values, Peak load, Joint costs, Economies of scale.

Identifiers: Optimum output, Two-part tariff.

Discussed is the applicability of theoretical principles of pricing to municipal water rates. Explored in relation to this are the alternatives of average cost vs. marginal cost pricing. In either case, whether or not a profit is possible, a loss is incurred at the optimal output if a single price is charged. Several possible ways to overcome the difficulty are given: (1) government subsidy, (2) receiving as revenue voluntary contributions for continuation of service, (3) setting up descending scale of prices, (4) a two-part tariff system, and (5) price discriminations. The problem of adjusting rates to different classes of consumers is considered in discussing joint costs. A detailed discussion of costs as functions of scale of output, and classification of costs is given. The merits of either capacity charge or peak load pricing are reviewed and considerations of the water demand in fire protection is discussed. Under-pricing and over-building in water supply are also considered. In conclusion, the results of previous discussions are drawn together and suggestions made for development of future municipal water rates. (Gargola-Chicago)

W69-00956

INSTITUTIONAL SUGGESTIONS FOR WATER QUALITY MANAGEMENT,

Resources for the Future.

Allen V. Kneese, and Blair T. Bower.

Managing Water Quality: Economic, Technology and Institutions, Baltimore: Johns Hopkins Press, 1968, Chap 14, pp 301-318, 1 tab, 11 ref.

Field 06—WATER RESOURCES PLANNING

Group 6C—Cost Allocation, Cost Sharing, Pricing/Repayment

Descriptors: *Water quality control, Non-structural alternatives, Water resource management, Institutional constraints, Adoption of practices, Regional analysis, State governments, Local governments, *Administrative decisions, Decision making, Federal government, Industrial wastes, Effluents, *Control systems, Optimum development plans.

Identifiers: Effluent charges, External costs.

To provide a firm foundation for efficient progress in water quality management an economic optimization approach is suggested. Agencies should be established with powers to plan and implement management programs for entire regions. Granted these powers agencies should be able to, (1) progress toward systematic methods for reflecting external costs associated with water discharges, (2) define, evaluate, and implement measures to reduce adverse effects of waste discharge, (3) produce more efficient operation of water quality management system, (4) adapt new knowledge and technology, (5) give consideration to impacts of spatial patterns of economic activities on water quality management. With the above factors as stated goals of regional water quality management, there are certain criteria which should be met if agencies are to be effective; i.e. the ability to internalize major externalities, implement relevant measures, take account of significant interrelationships, and provide opportunities for affected parties to have a voice in decisions. The role of the federal, state and local governments in the formulation of this regional is defined, with suggestions for the financing. Systems of direct regulation, charges for waste discharge, and payments to dischargers are discussed as possible means of revenue. The advantages and disadvantages are reviewed, and the system of effluent charges is recommended. (Gar-gola-Chicago)

W69-00959

A CURIOUS SOLUTION TO THE PROBLEM OF OPTIMAL PRICE REGULATION.

Stanford Univ., California.

James N. Rosse.

Am Econ Rev, Vol 58, No 4, pp 863-870, Sept 1968, 2 ref.

Descriptors: *Pricing, *Public utilities, Demand, Welfare (Economics), Elasticity of demand.

Identifiers: *Decreasing cost industry, Informative advertising, Paretian efficiency.

A special solution to the problem of setting an optimal price for a regulated declining cost utility is developed in this article. It is shown that intermittent average cost price regulation makes it profitable for such a utility to transmit price behavior information to consumers. Looking at the steady state analogue of an equilibrium generated by the introduction of such information, it is shown that average cost price regulation and consumer information are consistent with necessary conditions of Paretian efficiency if and only if all consumers have the same elasticity of demand for the product. Thus, the situation avoids the efficiency-redistribution dilemma of standard optimal price regulation theory. Idealized rate cards are suggested as a means of transmitting necessary information to consumers. (Seneca-Rutgers)

W69-01065

THE ECONOMIST'S ROLE IN WATER PRICING POLICY,

California Univ., Davis.

W. E. Johnston.

Proceedings Water Pricing Policy Conference, Report No 13, University of California Water Resources Center, pp 28-40, March 1968. 5 fig.

Descriptors: *Water requirements, Water resources development, Water demand, Water policy, *Pricing, *Elasticity of demand, Profit, Conservation.

Identifiers: Kern County Water Agency, Rationing.

In reality, use of the optimum economic criterion that marginal cost equal marginal value in use, is not appropriate for a water-supplying agency. To the firm, water is but one of several inputs. However, a public water agency's objective is commonly regarded as that of securing reliable water supplies for its members; profit maximization is not its goal. With investments of such magnitudes, as necessary for water resource development, the average cost curve usually declines throughout the range of system capacities. The appropriateness of using marginal-cost pricing when faced with a declining average cost curve is debatable. Water can be differentiated according to differences in time, place, and quality. This differentiability also makes the pricing problem more difficult. If distribution systems have a limited capacity, users must wait on a rotational system of water delivery, and this may increase the efficiency of their use of water. Variations in tax-toll mixes may provide incentives for allocation of water use to conform to district objectives. (Seneca-Rutgers)

W69-01077

WATER PRICING: A SOCIAL DECISION-MAKING PROCESS,

California Univ., Los Angeles.

Ernest A. Engelbert.

Proceedings Water Pricing Policy Conference, Report No 13, University of California Water Resources Center, pp 59-69, March 1968. 13 ref.

Descriptors: *Pricing, Water rates, Social change, *Social aspects, Water policy, *Decision making, Ethics, Aesthetics, Institutions, Water resources development.

Identifiers: Public objectives, *Behavioral sciences, Due process, *Multiple water pricing systems.

Social non-economic considerations have always permeated water policy decision-making processes. These may be categorized under four broad headings, namely (1) ethical considerations, (2) social policy considerations, (3) considerations involving due process, and finally, (4) aesthetic considerations. In actual practice, these are not so neatly categorized by our various water pricing systems, and indeed, are not easily separated. Under ethical deterrents, high priority is placed upon the use and development of water for the sustenance and protection of human life; it is also considered ethically desirable to conserve resources for future generations. Among the more important social policy objectives have been the use of water to facilitate regional and national growth; to influence the spatial distribution of population, and to promote the public's general welfare. Standards of due process are the procedures whereby individual rights are secured and maintained, they consciously establish water institutions and procedures that will minimize social conflict. Aesthetic factors are involved with society's interest in using and conserving water resources to protect the beauty, quality and liability of the natural environment. (Seneca-Rutgers)

W69-01082

INPUT-OUTPUT PROJECTIONS: CONSISTENT PRICES AND QUANTITY STRUCTURES,

Cambridge Univ., Cambridge, England. Dept. of Applied Economics.

Richard Stone.

L'Industria, Vol 102, No 2, pp 212-224, April-June 1968. 6 ref.

Descriptors: *Input-output analysis, *Least squares method, Forecasting, Constraints.

Identifiers: Variance matrix, *Best linear unbiased estimator, *Price vector, *Coefficient matrix, Factors of production.

In order to construct a coherent system for the projection year, it is necessary to introduce the prices of that year as well as the quantities. If we form initial estimates of factor and product prices the resulting system is not likely to be coherent because the initial estimates of prices are not con-

sistent with the initial estimates of the quantity structure. This paper shows how the well known method of adjusting conditioned observations in the method of least squares can be applied to the problem of making consistent input-output projections. There are three possible means of adjustment: (a) accept initial estimates of intermediate and primary coefficient matrices and adjust only product and factor prices; (b) accept initial estimates of these prices and allow the adjustment to fall on the intermediate and primary coefficients (c) adopt some compromise between these extremes. A numerical example is provided for all three cases. This method is simple and the difficulties associated with it are mainly practical. It can only be tested through applications. (Seneca-Rutgers)

W69-01105

6D. Water Demand

ARKANSAS WATER RESOURCES: SUPPLY, USE, AND RESEARCH NEEDS,

Arkansas Univ., Fayetteville.

Jared Sparks.

Water Resour Res Center Publ 2, 1967. 100 p, 15 fig, 10 tab, 25 ref. OWRR Project A-006-Ark.

Descriptors: *Research and development, Multiple purpose reservoirs, *Water supplies, Chemicals, Sediments, *Water pollution, Floods, *Water management (Applied), *Surface waters, *Ground water, *Hydrologic data, *Water utilization, Water balance, *Economics, Groundwater recharge, Limnology.

The purpose of this study is to identify Arkansas' water resources research needs based on economic backdrop of water supply and use conditions. Arkansas has an abundance of high quality water for present use. There are local conditions causing water problems, but, critical water problems in Arkansas are emergent and potential rather than actual. Causes of these problems are to be found mainly in the economic, legal, and social institutions surrounding water use--and particularly in the economic institutions. Research designed to improve economic efficiency criteria and to develop methods of applying such criteria to water resources planning, to water resources allocation, and to quality of water control would do much to mitigate water management problems in the future. Research of this nature requires more water data concerning supply, use, and costs associated with water use than are now available. Other promising areas of research include research on the nature of water and water cycle, applied research in areas of flood control, artificial recharge, measurement of pollution damage and costs, identification and treatment of pollution, limnology of artificial lakes, and the role of water resources in industry location. W69-00706

LISTS OF REFERENCES AND SELECTED BOOKS BEARING ON WATER RESOURCES IN MINNESOTA,

Minnesota Univ., Minneapolis.

William C. Walton.

Water Resour Res Center Bull 4, Dec 1966. 36 p, 711 ref. OWRR Project A-999-Minn.

Descriptors: *Water resources, *Reviews, *Bibliographies, Biology, Climatology, Forestry, Geology, Groundwater, *Lakes, Streams, Water pollution, Hydrology, Water supplies, Streamflow, Sociology, *Minnesota.

This bulletin lists 711 references on water resources in Minnesota including: Biological Aspects, Climatic, Forests and Water, General, Geology and Groundwater, Lakes, Land and Water, Legal Aspects, Streamflow and Floods, Water-based Recreation, Water Pollution, Water Resources, and Wetlands. Selected books bearing on the physical, biological and social aspects of water resources in Minnesota on the following subjects are also listed: Climate, Conservation,

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Recreation and Wildlife, Fluid Mechanics, Groundwater, Hydrology, Lakes and Biological Aspects, Mathematical and Computer Aspects, Social-Economic Aspects, Soils-Plants-Water, Streamflow, and Water Supply and Waste Disposal. W69-00731

EVALUATION OF WATER RESEARCH NEEDS IN ALASKA,
Alaska Univ., College.
Charles E. Behlke.
Inst Water Resour Rept, 1968. 9 p. OWRR Project A-006-Alas.

Descriptors: Water resources, *Water resources development, Climatic zones, Population, Cold regions, Permafrost, Water management, *Alaska, Evaluation, Planning, Arctic, Oil fields.

The water resource research requirements for Alaska reflect the needs of a rapidly expanding population and industrial growth in an unpopulated country. It appears that many problems which have been researched elsewhere must be restudied in Alaska because of climatic extremes. Most of the southern coastal areas of the State exhibit from 70 to 350 in. of runoff/yr and in much of the northern part of the State permafrost to great depths and seasonal frost lock virtually all water in a solid state for a major part of the year. Alaska is proving to be an area with vast petroleum reserves. These reserves are being brought into production and are resulting in development of previously unpopulated areas. The proper management of previously untouched waters requires knowledge of the nature of the existing resources and then an evaluation of the probable effects of alternative water uses in order to optimize the desirable use of Alaskan water resources. This evaluation of present conditions and analysis of future possible uses require vast amounts of research.

W69-00743

AN ACT CONCERNING USE OF WATER FROM RIVERS FOR PUBLIC CONSUMPTION.
Connecticut Public Act No 792 (1967).

Descriptors: *Water utilization, *Water permits, Administrative agencies, *Connecticut, Legislation, Water allocation (Policy), Water users, Public utilities, Public rights, Water distribution (Applied), Utilities, Water law, Legal aspects, Municipal water, Navigation, Reasonable use.

Any public water supplier is given permission to take water from any river if it applies to and receives a permit from the Water Resources Commission. The application must be consented to by a public service company if the company's rights are affected, or the Public Utilities Commission must approve the diversion. The Water Resources Commission makes an investigation, holds a public hearing, cooperates with other state agencies, and makes a determination with respect to the application. The permit may be revoked or modified by the commission if it is in the public interest to do so. Any person aggrieved by the commission's determination may appeal to the superior court. (Horner-Fla)
W69-00769

LITTLE WABASH RIVER BASIN STUDY, A COMPREHENSIVE PLAN FOR WATER RESOURCE DEVELOPMENT,
Illinois Department of Public Works and Buildings, Springfield Division of Waterways.
Bruce Barker, John B. Carlisle, and Raymond Nyberg.
Rep, State of Illinois, Springfield, Ill., 1967, 76 p, 29 fig, 21 tab, 36 ref.

Descriptors: Hydrology, Drainage, Irrigation, Research and development, Project planning, Financing, Administrative decisions, Soil classifications, Streamflow forecasting, Water sources, Control river basin planning, Water quality, Pollution

abatement, Waste water discharge, Biological oxygen demand, Flood damage control, Federal reservoirs, Irrigation, Drainage program. Identifiers: Well yield, Little Wabash River Basin, Louisville reservoir, Helm Reservoir, Illinois.

To provide a background for development, significant aspects of physical geography, basic economy, hydrology, and water supply are evaluated. Utilizing this information, research and recommendations are made in problem areas of water quality control, flood damage control, agricultural drainage and irrigation. Pollution problems in the basin are the result of inferior waste water treatment, high BOD loading of streams, and oil field pollution. The control of these will be mainly achieved through improved municipal waste water treatment facilities. It is recommended that flood damage control be implemented to the maximum extent consistent with economic efficiency. Measures given which satisfy these criteria are: (1) the control of urban encroachment; (2) reclamation of bottomlands; and (3) flood control reservoirs. Three proposed levee districts are recommended as the best means of achieving reclamation in the bottomlands for agricultural purposes. Since basin agriculture is becoming more important relative to total state agriculture, if it can be shown that irrigation is a good investment, these proposals should be implemented. The continued validity of the above recommendations is dependent on whether the basic data and derived relationships put forth truly represent present and anticipated future needs. If the above recommendations are implemented, the projected economic growth of the Little Wabash River Basin will not be limited. (Gargola-Chicago)
W69-00945

STATUS OF WATER RESOURCES USE, CONTROL, AND PLANNING IN THE UNITED STATES,
National Academy of Sciences-National Research Council, Washington, D. C.

Abel Wolman.
Journal of the American Water Works, Vol. 55, No. 1, 1963, p 1253-1272, 1 fig, 2 tab.

Descriptors: Water resources development, *Evaluation, Optimum development plans, Water supply, Water demand, Social aspects, Water allocation, *Decision making, *Project planning, Education, *Research and development, Water pollution, Hydrologic cycle, Scientific personnel. Identifiers: International implications.

Identified are the more significant problems in the water resource field, and in areas of physical science research that will contribute to more effective use of water resources. First, the general aspects of the behavior of water in the hydrosphere are reviewed and some general problems that arise from the physical characteristics of water supply and the nature of man's demand for it. The availability of water resources in the United States today is discussed and evaluated with respect to the demands for their use. Some general problems of water resources development and allocation in arid, semi-arid, and humid areas, are discussed as to both their physical and social aspects. Unique considerations that govern the administration and use of water, such as economics and the laws related to water use are reviewed, and suggestions for their improvement made. In regard to the physical science aspects of water research specific problems are discussed and research proposals made in order of priority. Forecasting and control of channel modifications, approximation of optimum water resources systems, streamflow forecasting, weather forecasting, and study of physiologic aspects of water quality, are the research needs which have the greatest benefit for all areas. (Gargola-Chicago)
W69-00952

NEW LOOK AT RESOURCES POLICY,
Cornell Univ., Ithica, New York, Eng Dept.
Gordon P. Fisher.

Journal of American Water Works, Vol. 57, No. 3, March 1965, p 255-61, 2 ref.

Descriptors: Water supply, Water demand, *Water resources management, *Project planning, *Investment, Water reuse, Pollution abatement, Market value, Water laws, Riparian rights. Identifiers: Public policy.

The water problem in the United States is not that of a widespread water shortage, but rather a water management problem. Five major factors contribute to this: (1) increasing demand for water, (2) conflicting demands for water resources, (3) concentration of demand in certain areas, (4) lack of regional management and coordination, and (5) lack of efficient organization for planning. Possible solutions to these problems are considered in areas of water costs, pollution, water laws, and reuse. In conclusion, suggestions for formulation of public policies which call for vast cooperative effort between engineers, economists, and lawyers are put forth. (Gargola-Chicago)
W69-00953

ECONOMIC CONSIDERATIONS FOR THE DESIGN OF WATER INSTITUTIONS,
Indiana Univ., Bloomington.

Jerome W. Milliman.
Public Administration Review, March, 1965, pp 284-289, 6 ref.

Descriptors: *Water resource management, Water law, *Water allocation, Marketing, Marginal product, Marginal costs, Pricing, *Economic evaluation, *Decision making, Regional analysis, Institutional constraints, Water transfer, Rates of return, Water supply, Marginal costs.

Identifiers: Marginal value, Modification of laws.

The problem of water resources appears to be not one of inadequate supply, but rather of rational allocation among competing uses. The solution lies in sensible management of resources, and in the application of economic principles in allocating existing supplies and in development of new supplies. A system of regional water management could deal more effectively with water problems than existing management methods. The fact that there are no uniform water laws results in a failure to deal with obvious externalities, and prevents development of an efficient market system. Suggestions for modifying present laws and defining the function of public agencies in the law are given. Two major economic principles: (1) equalizing marginal values in uses, and (2) marginal cost pricing are significant in water resource allocation. Ignoring the effects of these principles in water resource investments can lead to inefficient allocation of existing water supplies. Increased efficiency of water resource development lies in a merger of unapproved institutional and economic decision making frameworks. (Gargola-Chicago)
W69-00954

TRENDS IN WATER USE,
Partner, Pate, Hirn, and Bogue, Detroit, Michigan.
Stuart H. Bogue.
Journal of American Water Works, Vol. 55, No. 5, May 1963, p 548-54, 5 fig, 2 tab.

Descriptors: *Water use, Water rates, *Industrial use, Municipal water supply, Peak load, Water supply, *Water consumption, *Water requirements, Water distribution. Identifiers: New York (New York), St. Louis, Pittsburgh, Washington, D. C.

Enumerated are ten factors which affect water use. Large increase in per capita consumption of water is a result of new fixtures and appliances which use greater quantities of water. Variations in demand of industrial and residential rates are discussed; from data gathered it is shown that industrial use of water tends to minimize large fluctuations in demand, while residential use does not. Relations are drawn between such factors as home value, income

Field 06—WATER RESOURCES PLANNING

Group 6D—Water Demand

and water use. In conclusion, it emerges that there has been no appreciable depletion of water supplies. In fact there is no need to worry about the availability of water supplies if the citizens are willing to pay for them. (Gargola-Chicago) W69-00957

RESEARCH IN GROUND WATER ECONOMICS IN THE HIGH PLAINS AREA OF COLORADO,

Colorado State Univ., Fort Collins, Econ Dept.

Paul W. Barkley.

Pap, 18th Annu Expo Natl Water Well Assoc, Columbus, Ohio, Oct 5, 1966. 10 p. OWRR Project B-007-Colo.

Descriptors: *Ground water, *Colorado, Aquifers, Economics, Water users, Irrigation, Water Development, Wells, Irrigation wells, Water wells, Groundwater mining, Pumping, *Groundwater recharge.

Identifiers: *High Plains, USA, Eastern Colorado.

This report covers ground-water resources in a crescent shaped area along the eastern border of Colorado. In 1960 this area contained an estimated 80 million acre-ft in ground-water storage with 30 million acre-ft economically recoverable. The area includes 9000 sq mi that for decades had been a dry farming area. In 1960 fewer than 400 wells yielded 60,000 acre-ft for irrigation and an additional 10,000 acre-ft was supplied by wells for other purposes. From 1961 to 1964 an average of 200 wells per year were brought into production for irrigation. In 1965, annual yields from the aquifer were slightly in excess of the estimated natural recharge of 430,000 acre-ft. This area now is confronted with the problem of declining water tables. As farm operators switch to irrigate agriculture, nonfarm economy expands. These expansions must lead to some type of control. Insufficient information exists on dollar volume of on-farm and off-farm effects to be of service to legislatures. Ground-water development must proceed through combined efforts of irrigators, business groups serving irrigators and researchers.

W69-00986

AN ECONOMIC ANALYSIS OF WISCONSIN'S DIVERSION PERMIT SYSTEM FOR AGRICULTURAL IRRIGATION,

Wisconsin Univ., Madison, Agri Econ Dept.

Frank H. Osterhoudt.

Water Resour Res, Final Rep, 1967. 427 p, 17 fig, 75 tab, 33 ref, 3 append. OWRR Project A-008-Wis.

Descriptors: Water laws, *Water rights, Adoption of practices, Riparian land, *Riparian rights, Irrigation, Irrigation practices, *Permits, Irrigation wells, *Irrigation permits, Wisconsin, Bibliographies.

This study was conducted to learn the parts of the diversion permit system that would affect the economic decisions of current irrigators. This was done through the study of files of the Land and Water Use Section, Dept of Natural Resources, an area study of all irrigation of E Barron County and mapping of riparian status of about 50 mi of lakes and streams. In Wisconsin, riparian land is considered to include all government lots, quarter-quarter sections, and tracts of land actually owned when less than these legal subdivisions which are actually in contact with water. In addition, such other tracts adjacent to such above-named tracts also are riparian if owned by the same person and if they have come to present ownership in an uninterrupted chain of title from the original government patent. This is known as source of title test. Among the specifications of individual permits, it was found that allocation of water for irrigation by the source of title test was the major element to affect irrigators and appeared to be particularly unsatisfactory. Perhaps this study will provide a basis of data and ideas to develop an understanding and eventually an equitable allocation of Wisconsin's water supply.

W69-01000

EFFECT OF IRRIGATION METHOD ON WATER CONSERVATION,

Utah State Univ., Logan.

For primary bibliographic entry see Field 03F.

For abstract, see .

W69-01021

WATER USES IN THE NORTH PLATTE RIVER BASIN OF WYOMING.

Wyoming Univ, Laramie, Wyoming, Agricultural Experiment Station.

Richard T. Clark.

Research Journal 21, Agr. Exp. Stat., Univ. of Wyoming, Jan. 1967. 62 p, 1 map, 37 tab, 62 ref, 1 appendix.

Descriptors: *North Platte River Basin (Wyoming), *Irrigation, *Recreation, *Municipal water, *Industrial water, *Waste disposal, Demand. Identifiers: Economics, *Water utilization.

The present uses and needs of water are described so that future uses, needs, and demand for water may be estimated. Also, the information provided in the report may be used as a basis for future projects. The paper provides physical and economic description of the area. The uses of water for irrigation purposes, recreation, municipal, industrial, agricultural, and waste disposal are described. This discussion also describes legislation, projects, inventories, and developmental projects that pertain to the various uses of water. The potential demands for water in the areas of irrigation, recreation, residential, and industrial are estimated. After studying use of water in the North Platte River Basin, some conclusions can be reached: (1) Most tributary streams from Casper to the state line including the Laramie River are generally short of irrigation water. Some are even short in above average years. (2) Lands on North Platte tributaries in the upper reaches such as in and around Laramie lack late season water. (3) Lands along the Platte itself, especially below Casper, are not short of water in most years. (4) Most municipalities have adequate supplies for current demands but some have definite problems even in average water years. (5) There exists a demand for more water for recreational purposes. (6) Industries generally have been able to obtain enough water for their purposes. (7) More lands could be irrigated if the water were available. Under present water conditions, however, there is no extra water for irrigation in the North Platte drainage. (8) Pollution does not present a health hazard in the North Platte Basin, but in some areas it is detrimental to fishing. (Grossman-Rutgers)

W69-01062

STORAGE REQUIREMENTS FOR WATER IN THE UNITED STATES,

Resources for the Future, Washington, D. C. and U. S. Geological Survey, Washington, D. C.

George O. G. Lof, and Clayton H. Hardison.

Water Resources Research, Vol 2, No 3, pp 323-354, Third Quarter 1966. 6 fig, 11 tab, 9 ref, 1 disc.

Descriptors: *Water storage, *Costs, Evaporation, United States, Estimated costs, *Storage capacity, Discharge, Probability, Average costs, Marginal costs, Flows.

Identifiers: *Storage requirements, Carry-over storage, Seasonal storage, Water resource regions, Senate Committee Print 32, Net flow.

Storage requirements for various levels of streamflow regulation in the 22 major regions of the contiguous United States are presented and supersede those given in Committee Print 32 of the Select Committee on National Water Resources, U S Senate. At high levels of development, the storage required to provide the desired flow in 95 and 98 percent of the years is substantially larger than that previously given. Carry-over storage requirements based on probability routing of annual discharge are combined with seasonal storage requirements to give the revised storage requirements, which are then used to compute revised evaporation losses and revised cost estimates. The maximum net flow

that could be made available for the 22 regions for 98 percent of the years is shown to be 965 billion gallons per day (bgd) for which a storage capacity of 3.6 billion acre-feet would be required. A net flow of 922 bgd could be made available with 2 billion acre-feet of storage. An increment of flow above the 922 bgd could be made available with 2 billion acre-feet of storage. An increment of flow above the 922 bgd figure would have storage costs exceeding ten cents per thousand gallons delivered. (Seneca-Rutgers)

W69-01073

ASPECTS OF SURFACE WATER RESOURCES - HUMBOLDT RIVER BASIN, NEVADA.

Nevada Univ, Reno.

For primary bibliographic entry see Field 03F.

For abstract, see .

W69-01111

THE EFFECTS OF VARYING LAND AND WATER USE ON STREAMFLOW REGIMEN.

Wyoming Univ, Laramie.

Paul A. Rechard, and Frederick R. Potter.

Prog Rep, Water Resour Res Inst, June 1966. 41 p, 10 fig, 5 tab, 25 ref. OWRR Project A-999-WYO.

Descriptors: Irrigation, Municipal water, *Return flow, *Streamflow, *Water rights, Water utilization, Water measurement, Consumptive use, Hydrologic budget, Hydrologic equation, *Land use, Municipal wastes, Water consumption, Water resources development, *Prior appropriation, Treatment facilities, Wyoming. Identifiers: Laramie (Wyo.).

Urban growth in the West results in changing the patterns of streamflow in 1 or a combination of 3 ways, these are: (1) variation in consumptive use as particular areas change from irrigated agricultural land to municipalities; (2) peculiar hydrologic characteristics of urban areas that result from 'roofing over' the natural drainage basin; and (3) the effects on streamflow regimen of converting an irrigated area to dry land with concurrent transportation of the water to a municipality located many miles from the original point of use. The study of this latter effect is reported in this paper. Consumption of water by the City of Laramie and by an area north of the city irrigated from the Oasis Ditch was determined on a daily basis from May 1 until September 30, 1965. The regimen of the Laramie River was evaluated by measuring daily flows at 4 different locations during the same period. Tabular results are presented and discussed. Recommendations for further study are included.

W69-01130

LAKE-ORIENTED SUBDIVISIONS IN NORTH CAROLINA: DECISION FACTORS AND POLICY IMPLICATIONS FOR URBAN GROWTH PATTERNS. PART I - DEVELOPER DECISIONS,

North Carolina Univ, Chapel Hill.

Raymond J. Burby, III.

Water Resour Res Inst Rep 9, Nov 1967. 177 p, 6 fig, 18 tab, 53 ref, 4 appen. OWRR Project A-023-NC.

Descriptors: *Land development, *Community development, *Land use, Water quality control, *Environmental engineering, *Lake shores, Water zoning, Decision making, Aesthetics, Developed waters, Public health, Recreation facilities, Safety, *Lakes, Urbanization, Water policy, Watershed management, *Water properties, Water resources development.

This study examines the decisional variables which are important to developer-builders in selecting tracts of land for lake-oriented subdivisions. Public policies affecting development of these subdivisions are examined, and problems following development are considered in terms of the public interest with respect to watershed use, public safety, water quality, ownership and liability, and

local-state-federal regulations. The report is based on structured interviews with developers and public officials carried out during the summer of 1967. Included in the survey were 41 lake-oriented subdivisions paired with 41 nonlake-oriented subdivisions in 22 urban areas of North Carolina. An extensive series of hypotheses were tested and are reported in detail. One important finding is that the ability of developers to trade off positive values of site characteristics for environmental innovations, in order to achieve an optimum profit position, provides them with considerably more flexibility in their location decisions than has been previously thought to be the case. As the first step toward adequate control of lake-oriented subdivisions, recommendation is made that subdivision ordinances include provisions governing the use of lakes and other bodies of water in residential subdivisions.

W69-01155

6E. Water Law and Institutions

NEW HORIZONS IN WATER RESOURCES ADMINISTRATION, Resources for the Future.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-00705

THE LAW OF WATER POLLUTION CONTROL,
Mississippi State Univ., State College.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-00733

MUNICIPAL WATER RIGHTS,
Edward F. Taylor.
AWWA J, Vol 58, No 7, pp 856-866, Jul 1966. 11 p. 49 ref.

Descriptors: Legislation, *Municipal water, Cities, Federal-State water rights conflicts, *Local governments, Judicial decisions, Water rates, Public utilities districts, Water works, Water contracts.
Identifiers: *Municipal water rights.

The lack of a clear definition of federal and local rights in water has been of deep concern to the National Institute of Municipal Law Officers. The author recommends Congressional Bill S 1275, 88th Congress, 1st Session, which requires the US to conform to the same rules that bind other public or private claimants. When the Federal Government undertakes to appropriate water rights under state law rather than on the basis of eminent domain of navigational servitude, it must conform to the state requirements. The author cites several cases supporting the general rule that a municipality may exercise reasonable discretion in determining whether to extend its water services. Cases construing the obligations of a municipality once it extends its services to outside connections are also noted. Water contracts should be carefully drafted to prevent a construction of ambiguous terms against the drafter. Generally, there must be a clear showing that the rates set by municipal officers are unreasonable and arbitrary before they can be overruled. A municipal water authority may vary the rates among users in different classifications of consumption. But rates cannot be discriminatory within a class of users. Public Utility Commission authority over municipalities is discussed briefly. Reintroduced in 90th Congress as S 2530. (Molica-Fla)
W69-00745

QUIGLEY V VILLAGE OF HIBBING (RES IPSA LOQUITUR APPLIED IN CITY WATER LINE BREAKAGE).

129 N W 2d 765-772 (Minn 1964).

Descriptors: *Municipal water, *Pipelines, *Pipes, *Minnesota, Water law, Judicial decisions, Local governments, Legal aspects.
Identifiers: *Res ipsa loquitur.

This case involved damage sustained to plaintiffs' subbasement as a result of a break in a water service line, which extended from the main city line through a wall of the plaintiffs' building. The central issue in the case was whether the doctrine of res ipsa loquitur applied in a situation where water supplied commercially by a municipal corporation escaped from a line placed in a public street to carry water from a main to the premises of the user, where, after being metered, it is available for the use of the consumer. The trial court refused to apply the doctrine; but on appeal, the decision was reversed by the Supreme Court of Minnesota. After stating the criteria for application of the doctrine of res ipsa loquitur, the court recognized a division in the authority for utilizing the doctrine in a case like that before the court. However, the court concluded that upon the record the prerequisites for an application of res ipsa loquitur appeared as a matter of law. (Patterson-Fla)
W69-00746

H A BOSWORTH AND SON INC V TAMIOLA (DRAINAGE).

24 Conn Sup 328; 190, A 2d 506-511 (1963).

Descriptors: Eminent domain, Legal aspects, *Legislation, *Drainage, Land reclamation, Drainage effects, Surface drainage, Land development, Land use, Public benefits, Compensation, Damages, Condemnation, Judicial decisions, Water law.

The plaintiff filed a complaint seeking authorization pursuant to section 52-456 of the Connecticut General Statutes to drain land owned and being developed by it by any suitable means over or under and across the rear portion of the defendant's land. The plaintiff alleges that it has been unable to agree on the mode of drainage and the damages to which the defendants would be entitled and thus applies for power to drain its land across the defendant's land pursuant to the aforesaid statute. The defendant filed a demurrer attacking the complaint as one which contemplates a taking of property in violation of due process. The demurrer further asserts that sections 52-456 to 52-460, are unconstitutional. The court examines the history of the Drainage Act and concludes that it may be constitutional if used for the public good, but could be unconstitutional if the drainage is primarily for the benefit of the plaintiff. The court dismissed the defendant's demurrer stating the constitutionality of the Drainage Act could not be satisfactorily determined on the demurrer. (R. Smith-Fla)
W69-00747

GAMER V TOWN OF MILTON (PERCOLATING WATER).

195 N E 2d 65-67 (Mass 1963).

Descriptors: *Percolating water, Subsurface waters, Subsurface drainage, Recharge wells, Pumping, Soil analysis, Soil compaction, Drainage, *Groundwater, Ponds, Excavation, Recharge.

The defendant is the owner of a parcel of property known as the Turner's Pond area. The plaintiffs are the owners of residences which are adjacent to this area. The defendant entered into a contract with a contractor to excavate and remove gravel from the Turner's Pond area. In order to excavate and remove the gravel the contractor removed the water from the area by pumping it from the pond into a stream, where it flowed away. As a result of this operation water was withdrawn from the upper levels of the sub-soil causing settlement under plaintiffs' houses. This result was foreseeable to defendant. The court found the issue to be whether the contractor's procedures were negligent. The court held that there was such negligence since the

contractor had not taken proper precautions to protect the plaintiffs' adjacent land. The contractor could have dug observation holes, sheathed its excavations, and used recharge wells. (R. Smith-Fla)
W69-00748

STATE V COCKRELL (OWNERSHIP OF BEDS AND ALLUVION).

162 So 2d 361-384 (La 1964).

Descriptors: *Louisiana, *Ownership of beds, *Accretion (Legal aspects), *Water law, Judicial decisions, Navigable waters, Streams, Lakes, Watercourses (Legal), Boundary disputes, *Boundaries (Property), Riparian rights, Water policy, Legislation.

The case involves an action of trespass brought by the State of Louisiana et al against defendants Cockrell et al, who drilled a gas well on property plaintiffs claimed to be the bed of Six Mile Lake. Plaintiffs' theory was that defendants' well was on the bottom of a lake navigable at the time of admission into the Union, and therefore the lakebottom was owned by the state by virtue of its inherent sovereignty. Defendants claimed the well was drilled on alluvion in front of defendants Zenors' property. In essence, defendants claimed that the lake was a 'river or stream' within the meaning of the term as used in LSA-CC Article 509, which provides that owners of lands adjoining rivers or streams are entitled to accretions which imperceptibly form alluvion attached to the shore. After careful examination of relevant cases and facts in issue, the court held for the defendants, stating, *inter alia*, that Six Mile Lake was an 'other stream' under LSA-CC Article 509 and therefore, unlike the case with true lakes having no currents, alluvion belongs to the riparian owner and not the state. (Patterson-Fla)
W69-00749

CULBERTSON V GROSS (SURFACE RUNOFF).

77 York 50-55 (Pa Com Pl 1963).

Descriptors: Surface runoff, Surface water, Drainage, Flooding, Drainage water, Rain water, Soil erosion, *Surface drainage, Slopes, Pipes, Artificial watercourses, Flow, Land development.

This is a dispute between adjoining land owners over the drainage of surface water. Plaintiffs by their complaint seek an injunction restraining defendant from obstructing the water flow from their land to his, and also request damages for injury to their land as a result of the consequent flooding. Defendant denied plaintiff's right to have the water flow as stated and counter claimed for an injunction restraining plaintiffs from discharging the water on to his land. The court applied the rule that one may not by artificial means gather water into a body and precipitate it upon his neighbor's property. The court concluded that both parties will have received equitable treatment if the plaintiffs reduce length of their drainage pipe and defendants accept the resulting more natural flow for absorption by his land and conveyance of any excess through his drainage ditch. Plaintiff was awarded no damages since the court found no permanent injury or reduction in the value of the land as a result of the flooding. (R. Smith-Fla)
W69-00750

BOETTCHER V STROCK (ALTERATION OF FLOW).

77 York 86-89 (Pa Com Pl 1963).

Descriptors: Boundaries (Property), Streams, *Streamflow, Floods, Running waters, Bank erosion, *Retaining walls, Stream erosion, Natural flow, *Alteration of flow, Storm runoff, Boundary disputes, Legal aspects.

The properties of the parties are adjacent to each other. In 1954, the immediate predecessor in title to the defendants erected a wall on a portion of the

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

South side of the stream which forms a common boundary between the two properties. This wall changed the bank of said stream so that it was vertical instead of sloping. The defendants, after the flood of 1960, rebuilt the wall on the same concrete footer that had originally been built by Whiteacre. The position of the plaintiffs is that the defendants have, by the maintenance of the wall, produced two results, (1) increased the amount of water flowing over plaintiff's land and (2) caused the stream to change its course so as to encroach on plaintiff's land. The court in dismissing the plaintiff's complaint held that although equity has jurisdiction to grant a remedy for continuing trespass that would result from interference with the flow of the creek or flooding, no such violation had been proven as a result of the defendants conduct. (R. Smith-Fla)
W69-00751

TREADWELL V WALDEIER (COMMON LAW RULE OF SURFACE DRAINAGE).

34 Misc 2d 339, 228 N Y S 2d 390-394 (1962).

Descriptors: *New York, *Surface runoff, *Regulation (Legal aspects), *Water rights, Water law, Judicial decisions, Surface drainage, Drainage water.

Plaintiff brought this action for an injunction to restrain defendants, sued individually and as the Board of Education of Union Free School District of the Village of Ardsley, from diverting surface drainage waters from defendant's school property into a pond to the north of plaintiff's land in which plaintiff had certain easement rights. The court distinguished the common law rule of surface drainage from the civil law rule. Under the common law rule, which is the law in New York, neither upper or lower owners hold a dominant or servient estate with respect to each other. Both have equal rights to improve their property come what may to the surface water, provided the improvements are made in good faith to fit the property for some rational use and the water is not drained into the other's property by artificial means. Although artificial means were used here, the court refused to grant the injunction because the plaintiff failed to prove an increase in the flow of water as a result of defendant's actions. (Patterson-Fla)
W69-00752

NORMANOCH ASS'N INC V DEISER (OWNERSHIP OF BEDS).

40 N J 100 190 A 2d 845-852 (1963).

Descriptors: Lakes, Lake beds, *Lake shores, Boundaries (Property), Boundary disputes, Legal aspects, *Ownership of beds, Water law, Dredging, Surveys, Mapping.

The issue which confronted the court was the question of title to the subaqueous lands in that portion of Culvers Lake adjacent to the high land undisputedly owned by defendant. The court ruled that this was similar to an action of ejectment and thus the plaintiff must prove that he is the owner of the lands involved. The chain of title of both parties was examined in great detail and the court concluded the solution to the problem was in the location of the lake shore in 1905. The first accurately surveyed location of the shoreline of the water bordering defendant's lot is that furnished by plaintiff in 1959. The defendant's deed, however, contains a call for a natural monument which creates a presumption that the line as delineated by the first survey has existed in such conformation and has continued unchanged from the date of the original deed. The court held title to the bed of Culver Lake was in plaintiff and enjoined the defendant from using the waters for a dock or other sundry purposes. (R. Smith-Fla)
W69-00753

MANUAL ON PROBLEMS OF ACCRETION,

Frank I. Towle.

Manual on Problems of Accretion, pp 1-101, (second printing) 1959. 102 p, 5 fig, 3 map, 6 photo, 4 dwg, 7 chart.

Descriptors: *Accretion (Legal aspects), Surveys, Meanders, *Boundaries (Property), Legislation, Ownership of beds, Aerial photographs, Photography, Hydrograph, Flow measurement, Riparian rights, Islands, Beds, Navigable waters, Bank erosion, Shores, Avulsion, Hydrograph analysis.
Identifiers: Flow duration curve, Isopleth.

Appraisers, title examiners, attorneys, and engineers should find this manual useful in the evaluation of the merits of claims which involve the ownership of land formed by accretion and the examination of titles to properties abutting rivers, streams and other bodies of water. The manual includes an outline of suggested procedures for determining the historical boundaries of riparian property, and a list of the federal, state and county agencies from whom pertinent material may be obtained. It is amply illustrated and includes sketches of some of the more common methods used by the courts for the apportioning of alluvion. The manual also explains the value of aerial and ground photographs, and the application of nomographs, hydrographs and flow-duration curves to the problem of land accretion. (R. Smith-Fla)
W69-00754

FEDERAL PROJECTS FOR IRRIGATION AND WATER SUPPLIES.

For primary bibliographic entry see Field 03F.

For abstract, see .
W69-00757

TENNESSEE VALLEY AUTHORITY.

16 USCA Secs 831-831h-1.

Descriptors: *Tennessee Valley Authority Project, *Tennessee River, Mississippi River Basin, *Flood control, Channel improvement, *Navigation, Eminent domain, Dams, Reservoirs, Project planning, Federal government, Relocation, Legislation.

The Federal Government, for the primary purposes of controlling the destructive flood waters in the Tennessee and Mississippi River Basins and the improvement of navigation in the Tennessee River, created the Tennessee Valley Authority (TVA). TVA was vested by statute with enumerated powers to carry out its objectives. The right of eminent domain, exercised in the name of the United States, and the acquisition of real estate by purchase or condemnation, with title being taken in the name of the United States, are among those enumerated powers. Real estate thus acquired would be used for the construction of dams, reservoirs, navigation projects and other structures along the Tennessee River and its tributaries for the promotion of navigation and control of flood waters in the Tennessee and Mississippi River drainage basins. Where such construction would flood or destroy lands, easements, or rights-of-way belonging to private persons, corporations, or local governmental agencies, TVA is authorized to convey replacement land by warranty deed. Also, if such construction impairs or damages any bridge, highway or railroad structure over, across or upon the Tennessee River or its tributaries, the corporation shall compensate the owners of such structures for the cost of reconstruction, relocation or replacement. The corporation is directed, in the operation of any dam or reservoir in its possession, to regulate stream flow primarily for the promotion of navigation and control of floods. (Geraghty-Fla)
W69-00758

TENNESSEE VALLEY AUTHORITY.

16 USCA Secs 831h-2 to 831dd.

Descriptors: *Tennessee Valley Authority Project, Tennessee River, *Electric power, *Transmission

(Electrical), Dams, Financing, *Water resources development, River basin development, Conservation, Condemnation, Transmission lines, Legislation.

Identifiers: Clinch River.

TVA, in order to avoid the waste of water power, is authorized to provide and operate facilities for the generation, transmission and marketing of electricity. Surplus electric power, not needed by TVA for the operation of locks or other structures, is to be sold to states, local governments, private individuals and corporations. There are numerous provisions regarding such sales, including provisions for the purchase or lease of transmission lines by TVA. Financing of construction projects is provided for through the use of bonds. Specific authorization is granted for the construction of Cove Creek Dam across the Clinch River, including the right of eminent domain and condemnation to acquire the necessary property. To aid in the conservation and development of the natural resources of the Tennessee River drainage basin and adjoining territory, surveys and general plans for orderly and proper physical, economic and social development of that area and to be promulgated. Construction of dams, appurtenant works or other structures affecting navigation on the Tennessee River System are prohibited unless plans for such construction are first approved by TVA. Notes and annotations are included and the publication is updated by pocket part supplements. (Geraghty-Fla)
W69-00759

DESIRABLE FEATURES OF WATER RIGHTS LAWS.

Nebraska Dept of Water Resources, Lincoln, Nebr.

For primary bibliographic entry see Field 06B.

For abstract, see .
W69-00760

SUPPLEMENTARY HISTORY OF TITLE OF MASSACHUSETTS TO SUBMERGED SEA LANDS.

Richard Wait.

Mass L Q, Vol 36, No 1, pp 17-26, May 1951. 10 p.

Descriptors: *Massachusetts, *Ownership of beds, Political aspects, *Water law, Judicial decisions, *Boundary disputes, Federal-state water rights conflicts.

Identifiers: *Ownership of seabeds, Constitutional law.

The purpose of the article is to clarify what the author believes to be a mistake of law made by the U S Supreme Court in the California case, 332 U S 19. In that case, the court rejected as unsound the first premise of California's argument that the original thirteen states owned submerged lands off their shores at least to the 3 mile limit, and hence California should have similar property under the 'equal footing' clause of the Constitution. The author accuses the court of rejecting the good title of the original thirteen states to their submerged lands without discussing its muniments. He then sets forth and analyzes the documentary evidence of Massachusetts' title to her submerged lands, tracing the title back as far as 1629 and continuing the chain through the present. The author also takes issue with the position of the court that prior to the 19th Century the law recognized no property in submerged offshore lands. (Patterson-Fla)
W69-00761

THE TIDELANDS CONTROVERSY: A STUDY IN DEVELOPMENT OF A POLITICAL-LEGAL PROBLEM,

William K. Metcalfe.

Syracuse L Rev, Vol 4, No 1, pp 39-89, Fall, 1952. 51 p, 3 tab, 210 ref.

Descriptors: Continental shelf, *Tidal waters, Administrative decisions, Coastal plains, *Political aspects, Control, Federal government, Interstate

compacts, *Federal-state water rights conflicts, Public lands, State governments, *Ownership of beds, Legal aspects, Judicial decisions, Legislation, Preferences (Water rights).

The development of the tidelands controversy as it became both a political and legal question and the interplay of executive, legislative and judicial forces is presented. The executive and legislative aspects are emphasized. The origins of the tidelands controversy are discussed. The key issue was whether or not the federal government or the states or private individuals owned offshore lands rich in oil resources. The Supreme Court finally resolved the controversy in favor of the federal government. The intense political overtones of the events leading up to the court's decisions are presented in considerable detail. The repercussions of the decisions are similarly treated. States having oil resources in offshore lands vehemently argued for state ownership of these lands. Republicans and Southern Democrats supported state claim bills in Congress, but could never muster sufficient votes to override presidential vetoes. It was concluded that the 1952 election would resolve the controversy. Eisenhower favored state ownership while Stevenson favored federal ownership. (Pfeiffer-Fla) W69-00762

POLLUTION OF WATERS.

For primary bibliographic entry see Field 05G.
For abstract, see .
W69-00763

REAL PROPERTY - WATER RIGHTS - LIABILITY FOR DISCHARGE OF SURFACE WATER,

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00764

SALT WATER FISHERIES AND CONSERVATION - WATER BOTTOMS.

Fla Stat Sec 370.03 (1967).

Descriptors: *Florida, *Ownership of beds, State governments, Navigable waters, Oysters, Clams, Administrative agencies, Interstate, State jurisdiction, *Commercial shellfish, Public rights, Water law, Legal aspects, Boats, *Legislation, Beds under water.

All beds and bottoms of navigable rivers, bayous, lagoons, lakes, bays, sounds, inlets, oceans, gulfs and other bodies of water within the jurisdiction of Florida are the property of the state except such as may be held under some grant or alienation previously made. The state board of conservation has exclusive power and control over all water bottoms, not held under some grant or alienation previously made, including any which may revert to the state by cancellation or otherwise. The board may lease such bottoms to any person irrespective of residence or citizenship, upon such conditions as it may elect to impose. No such lessee shall release, sub-lease, sell or transfer any such water bottom or property. All grants prior to June 1, 1913, made in pursuance of then existing laws are confirmed if the recipient of the grant, his heirs or assigns have complied in good faith with requirements of these laws. (R. Smith-Fla)
W69-00765

THE DEVELOPMENT AND PRESENT STATUS OF WATER RIGHTS AND WATER POLICY IN THE UNITED STATES,

Wells A. Hutchins.
J Farm Econ, Vol 37, No 5, pp 866-874, Dec 1955.
9 p, disc.

Descriptors: *Riparian rights, *Prior appropriation, *Federal-state water rights conflicts, Navigable rivers, Interstate compacts, Groundwater, Percolating water, Legislation, State governments, Federal jurisdiction, History, Water law.
Identifiers: Interstate commerce.

In the East the riparian doctrine prevails. Some western states recognize both riparian and appropriative rights, others appropriative only. Both doctrines show weaknesses. In riparian states a difficult problem is that of the unused riparian right. The appropriative doctrine is plagued with the perpetuation of rights to specific quantities of water regardless of subsequent economic changes. Courts are reluctant to order prior appropriators to make extensive changes in long-used methods of diverting, conveying, and applying water. A new area of development is the enactment of groundwater legislation. More experience with such statutes is needed before appraising their workability. Federal water policies are derived from the commerce power. In some respects federal and state water policies conflict. Examples of coordination, however, include state control over navigability only in the absence of paramount federal control, and construction of reclamation projects with federal funds under water rights acquired pursuant to state laws. (Kahle-Fla)
W69-00766

AN ACT RELATING TO TOWN ROADS AND COUNTY HIGHWAYS: AMENDING MINNESOTA STATUTES 1965, SECTION 164.07, BY ADDING A SUBDIVISION AND MINNESOTA STATUTES 1965, CHAPTER 163, BY ADDING A SECTION.

Minnesota Acts Ch 723 (1967).

Descriptors: *Minnesota, Legislation, *Roads, *Surface runoff, *Ditches, Surface drainage, Highways.

Minn Stat Sec 164.07 and Ch 163 (1965) are amended to direct that town boards and county boards, when considering petitions for vacation of roads, consider the necessity of the lateral ditches along such roads for the drainage of the adjacent lands. Where such boards find that the ditches promote the public health and welfare, they are authorized to retain the right of access to the ditches for their maintenance. Adjacent landowners are prohibited from interfering with the drainage facilities. (R. F. Williams-Fla)
W69-00768

PRESIDENT'S MESSAGE ON CONSERVATION AND WATER MANAGEMENT,

Lyndon B. Johnson.
U S Code Cong and Admin News, Vol 1968, No 2, pp 561-566, April 5, 1968. 6 p.

Descriptors: *Legislation, *Administrative agencies, Water pollution control, *Water pollution treatment, Water quality control, Sewage treatment, Water management (Applied), *Federal government, Standards, Arizona, Colorado, Oil wastes.

The President reviewed past water pollution and management legislation and the need for more programs. He asked Congress for action on proposed and pending legislation and more funds for existing programs. The President made the following recommendations: (1) An appropriation of \$225 million for grants under the Clean Water Restoration Act to speed the construction of water treatment plants; (2) Legislation be passed to allow the Secretary of Interior to make annual installment payments under this act in addition to lump sum grants to permit the Federal Government to make larger long range construction commitments; (3) That a Safe Drinking Water Act which would establish minimum requirements for public drinking water be passed; (4) The establishment of a National Water Commission which was then in conference committee; (5) Authorization of the Central Arizona Project which would divert waters of the Colorado River to arid portions of Arizona; and (6) Passage of the Oil Pollution and Hazardous Substances Control Act of 1968 which would strengthen previous legislation in this area. (R. H. Watson-Fla)
W69-00770

GARBAGE DISPOSAL AND WASTE ALONG STREAMS.

Ohio Laws 1967, Ch H 152.

Descriptors: *Legislation, *Ohio, *Waste disposal, Domestic wastes, Water pollution control, Administrative agencies, Watercourses (Legal), Streams, Cities, Zoning.

Identifiers: Attorney general, Injunction.

The Act amends sections 3767.32, 3767.33, and 3767.99 of the Revised Code. Section 3767.32 now provides that no person shall place or dispose of garbage, wastes, or anything else of an unsightly or unsanitary nature in any stream, or other watercourse, except those waters which do not combine with natural surface or underground waters, or upon the bank thereof where the garbage is liable to be washed into the water. Certain exemptions are specified. Section 3767.33 provides that no zoning commission, municipal corporation, or other governmental authority, except the water pollution control board, may authorize the placing or disposal of materials in or upon the banks of such watercourses after January 1, 1968, where such disposal would be prohibited under section 3767.32. Such placing or disposal may be enjoined by the common pleas court upon application by the attorney general or other specified officers or agencies. Section 3767.99 provides penalties for violations of certain sections of the Revised Code, including a fine of not less than \$25.00 nor more than \$500.00, or imprisonment for not more than 30 days, or both, for violation of section 3767.32. (Smidish-Fla)
W69-00771

HANDBOOK OF BASIC WATER LAW (WITH SPECIAL REFERENCE TO LOUISIANA),

Louisiana Water Resources Research Institute, Louisiana State U, Baton Rouge.

George W. Hardy III.

Handbook of Basic Water Law (with special reference to Louisiana) pp A1-A14, B1-B26, C1-C37, June 1966. 77 p, 46 ref, append.

Descriptors: *Louisiana, *Saline water intrusion, Aquifers, Encroachment, Legislation, Judicial decisions, Civil law, *Legal aspects, Groundwater.

A compilation of materials is presented to serve as a basis for the study of possible legal solutions to problems encountered in the study of salt water intrusion into fresh water aquifers in East Baton Rouge Parish, Louisiana. A memorandum discusses the present state of the water law in Louisiana to serve as a basis for seeking answers to legal problems that may arise if groundwater is water from surface streams is imported for use in the Baton Rouge area. Summaries of statutory water law are presented to compare the efforts of Cal, Colo, Fla, Ill, Ind, Neb, N J, Texas, in dealing with the problem of preservation of fresh ground water. A compilation of Louisiana statutory materials and court decisions is presented as a research tool for the evaluation of legislation or other solutions to the salt water intrusion problems in the Baton Rouge area. (Molica-Fla)
W69-00773

DELAWARE RIVER BASIN COMMISSION.

For primary bibliographic entry see Field 06B.
For abstract, see .
W69-00774

OFFICE OF WATER RESOURCES RESEARCH, DEPARTMENT OF THE INTERIOR.

18 CFR Ch 4, Secs 501-508 (1968).

Descriptors: *United States, *Water Resources Research Act, Legislation, Allotment, Grant, State government, *Universities, *Water conservation, Training, Inspection, Water supply, Hydrologic cycle, Administrative agencies.

Identifiers: Office of Water Resources Research, Agriculture Experiment Stations.

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This act creates a national program of water research. The Department of the Interior controls the Office of Water Resources Research. Funds to establish a research institute are available to each state when associated with a college in that state. These institutes conduct research and train scientists in such areas as the hydrologic cycle, supply and demand of water, water conservation, and increasing water supply. Grants are available when matched with state or other non-federal funds. Grants for research into any aspect of water problems may be given to entities other than the institute. The requirements for obtaining institute allotments and grants to other entities are provided. The Director of the Office of Water Resources Research determines whether applications for allotments, grants or contracts are to be accepted. The Act describes the fiscal and accounting procedures to be used. Various reports by fund recipients are required. Representatives of the Director and of the Comptroller General may conduct audits and inspections of all recipients of funds. (Childs-Fla)
W69-00775

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, DEPARTMENT OF THE INTERIOR.

For primary bibliographic entry see Field 05G.
For abstract, see .
W69-00776

WATER RESOURCES COUNCIL.

For primary bibliographic entry see Field 06B.
For abstract, see .
W69-00777

RIVERS AND HARBORS - APPROPRIATIONS PL 90-483.

U S Code Cong and Adm News, Vol 1968, No 10, pp 3505-3528, Sept 20, 1968. 25 p.

Descriptors: *Federal government, *Grants, Navigation, *Legislation, Flood control, *Rivers and Harbors Act, Beach erosion, Basins, Federal budgets, Costs.

Appropriations for the fiscal year 1968-69 under the Rivers and Harbors Act are listed. Thirty appropriations for the improvement of navigation, exceeding \$285 million, were approved. Extensive appropriations were also approved to prevent beach erosion throughout the nation. Appropriations exceeding \$600 million were approved for flood control measure in thirty areas of the nation. Additionally, \$466 million was appropriated for the prosecution of a comprehensive plan for the development of twelve listed basins by the Secretary of the Army. (R. H. Watson-Fla)
W69-00778

AN ACT REORGANIZING AND RENAMING THE RHODE ISLAND WATER RESOURCES COORDINATING BOARD, AND EXTENDING ITS POWERS AND DUTIES.

For primary bibliographic entry see Field 06B.
For abstract, see .
W69-00780

BOETTLER V BOARD OF TOWNSHIP TRUSTEES (CIVIL RULE OF SURFACE RUOFF).

For primary bibliographic entry see Field 04C.
For abstract, see .
W69-00782

HATFIELD TOWNSHIP V LANSDALE MUNICIPAL AUTHORITY (WATER WELLS-REASONABLE USE).

For primary bibliographic entry see Field 04B.
For abstract, see .
W69-00784

YOUNG AND SONS, INC V KIRK (MUDFLOW FROM ROAD CONSTRUCTION).
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-00785

BODIN V GILL (WATER DAMAGE THROUGH NEGLIGENCE DESIGN).
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-00786

PAINTER V ALEXANDRIA WATER CO (TRANSFERABILITY OF FLOWAGE RIGHTS).
202 Va 431, 117 S E 2d 674-678 (1961).

Descriptors: *Virginia, Judicial decisions, *Dams, Flow control, Ponding, Competing uses, Prior appropriation, Condemnation, *Relative rights, Easements, Submergence, Water resources development, Flood plains, *Land tenure.

This was a condemnation proceeding by the water company, defendant here, under color of a deed of flooding rights, against Painter, plaintiff, grantee of Pagne. The commissioners' report favoring the water company was accepted by the trial court over Painter's objections, and Painter brought this suit. This court affirmed the decision. The deed between Pagne and the defendant's predecessor created two separate flowage rights in the former company, which vested immediately upon the deed's execution and delivery. Since the rights had vested immediately, and were not contingent upon the happening of any future event, there was no difficulty arising out of the rule against perpetuities. The sale of such rights to the defendant at a later date was perfectly proper and the company could, under its deed, condemn certain of the plaintiff's lands. A landowner can grant to another an easement running with the land to overflow that land, and such easement is enforceable against later owners. (Blunt-Fla)
W69-00787

PIKE COUNTY BD OF EDUC V BELFRY COAL CORP (INJUNCTION AGAINST DRAINAGE FLOODING).
346 S W 2d 37-38 (Ct App Ky 1961).

Descriptors: Judicial decisions, *Kentucky, *Landfills, Surface drainage, *Obstruction to flow, Floods, Rainfall.
Identifiers: Injunctions, Estoppel.

Plaintiffs owned and operated a garage. Defendant Board of Education owned adjoining property. Originally the land owned by the Board had a lower elevation than the floor of plaintiffs' building. Natural drainage flowed onto the Board's property. The Board decided to build a playground in this area. This was done by filling it with dirt and rock to an elevation approximately four feet higher than the level of plaintiffs' floor. The trial court found that defendant's fill constituted an artificial obstruction to the drainage and substantially contributed to the flooding of plaintiffs' premises during rainfall. The appellate court affirmed, holding there was adequate proof that the change caused an increase in the amount of water cast upon the plaintiffs' premises. Defendant contended plaintiffs were estopped to obtain this relief because they encouraged defendant to spend money in an unsuccessful attempt to alleviate the situation. The court held that the alleged estoppel developed after the suit was filed and that plaintiffs, by insisting that certain steps be taken, were not precluded from claiming that all steps be taken which were necessary to right the wrong committed by the defendant. (Smodish-Fla)
W69-00788

HOLLEY V STATE (OBSTRUCTION OF DRAINAGE).
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-00789

AN ACT AUTHORIZING THE STATE OF INDIANA TO COOPERATE WITH THE UNITED STATES IN THE CONSTRUCTION, OPERATION AND MAINTENANCE OF MULTIPLE PURPOSE RESERVOIRS.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00790

AN ACT TO PROTECT INTAKE OF PUBLIC WATER SUPPLY.

Maine Public Law Ch 283 (1967).

Descriptors: *Maine, Water supply, *Cities, *Intake, Legislation, Water quality, Regulation, *Utilities, Water pollution sources, Water pollution control.

Title 22 of the Maine Revised Statutes is amended by adding a new section 2437. Authorization is given to any water utility or municipality which supplies water to the public from a lake or pond to mark off an area not exceeding 100 feet in radius around its point of intake. No person shall moor or anchor a boat or carry on ice fishing within such radius. Violation of this provision is deemed a misdemeanor punishable by up to a \$50 fine per offense. This act is not to be construed as affecting any private or special law granting a water utility or municipality greater controls for protection of water intakes. (R. F. Williams-Fla)
W69-00791

NORTH CAROLINA WELL CONSTRUCTION ACT.

North Carolina Laws 1967, Ch 1157.

Descriptors: *North Carolina, Legislation, Well regulations, *Groundwater, *Administrative agencies, Administration, *Well permits, Water conservation, Water quality, Withdrawal, Wells, Pumps.
Identifiers: Water quantity.

The Board of Water Resources is authorized to adopt rules and regulations governing the location, construction, repair and abandonment of wells, and for the installation and repair of pumping equipment. Notice and public hearings are required for the adoption of regulations. Prior permission shall be obtained from the Board for proposed wells above a certain capacity or in areas where permission is necessary to protect groundwater resources. Other general standards and requirements which the Board must follow are set out (Sec 87088). The Board is granted rights of entry and access to all property to insure compliance with its regulations. Alleged violators must be served with notice of the violation. A public hearing is required where the alleged violator requests it. The rules and procedures of such hearings are set out, judicial review is provided for, and a penalty of \$100 per violation is set. The Director of the Department of Water Resources is authorized to bring suit in the name of the state to enjoin violation of this act or the Board's regulations. (R. F. Williams-Fla)
W69-00795

AN ACT TO IMPOSE A PENALTY FOR THE UNLAWFUL USE OF AN OUTLET OF ANY IN-LAND PUBLIC WATER.

Laws of New Hampshire Ch 349 (1967).

Descriptors: *New Hampshire, Legislation, *Inland waterways, *Outlets, *Outlet works.
Identifiers: *Penalties.

Chapter 484 of the Revised Statutes relating to lake levels, is amended by adding a new section 484:3-a. A fine not exceeding \$1,000 is provided for anyone who disturbs the outlet and the instrumentalities connected therewith, of any inland public water in an unlawful manner under the chapter. This statute is effective September 1, 1967. (R. F. Williams-Fla)
W69-00796

PETTENGILL V TURO (OBSTRUCTION OF WATERCOURSE).

193 A 2d 367-376 (Me 1963).

Descriptors: Surface water, Natural flow, Water law, Flooding, Flood damage, Surface runoff, *Maine, Ponding, *Damages, Drainage, Leaching, Wells, Water wells, Septic tanks, *Obstruction to flow, Watercourses (Legal).

Between the property of the plaintiff and that of the defendant was a driveway owned by the defendant. In the fall of 1959, defendant raised the grade of the driveway without providing for sufficient drainage. As a result of this, water was impounded on the rear yard of plaintiffs property and overflowed his well and sanitary drainage system. The court stated that the heart of the case was whether or not the impounding of the water by the defendant, by virtue of his elevating the roadway, came about by his impediment only of the natural runoff of surface water, or whether it blocked a watercourse. Since only obstruction of a watercourse is actionable the court ruled the case was tried by implied consent upon the watercourse theory. The court affirmed the lower courts judgment for the plaintiff, but remanded the case for a new trial solely on the question of damages. (R. Smith-Fla) W69-00799

POWERS, DUTIES, AND FINANCING OF WATERSHED DISTRICTS.

Ohio Laws 1967, Ch H 791.

Descriptors: *Legislation, *Ohio, *Watershed management, *Water districts, Administration, Administrative agencies, Government finance, Financing, Adoption of practices, Budgeting, Floodways, Channels, Water resources development, Beneficial use, Adjudication procedure, Watersheds (Basins), Permits, Judicial decisions. Identifiers: Injunction.

The Act amends several sections of the Revised Code and adds two new ones. Section 6105.01 defines 'floodway' and 'watershed county.' Sections 6105.06 through 6105.08 deal with procedure for appointing boards of directors for watershed districts, their composition, terms of office, compensation, and the adoption of expenditure budgets for watershed districts. Section 6105.11 provides that watershed districts may sue and be sued as political subdivisions of the state. Section 6105.12 enumerates the means by which the boards of directors may obtain the development and most beneficial use of water resources. Sections 6105.131 through 6105.134 deal with the designation of restricted channels and restricted floodways, the required written consent of the board of directors before altering, obstructing, or changing the grade of such channels and floodways, and appeal from the board's decision. Section 6105.15 through 6105.17 deal with the submission and adoption of expenditure budgets for watershed districts. Section 6105.22 authorizes the boards of directors to bring suit for injunction against violations of sections 6105.01 through 6105.21. Section 6105.99 provides a fine of not less than \$100 nor more than \$1,000 for violation of sections 6105.13 or 6105.133. (Smidish-Fla) W69-00798

ARKANSAS LOUISIANA GAS CO V TRAHAN (TITLE TO ALLUVION FORMATIONS).

158 So 2d 456-457 (La 1963).

Descriptors: *Judicial decisions, *Louisiana, *Alluvion, Rivers, *Riparian rights, Banks, Water law, Legal aspects, Relative rights.

This case was a concursus proceeding, where the plaintiff deposited in court an amount equal to the value of production from a unit well which it was operating under a mineral lease. There were rival claimants to this fund, and plaintiff desired that the court determine which claimant was entitled to the

fund. The property in question, upon which the well was located, was alluvion formation from a river. One claimant contended that its title, purchased from the rival claimant, reached to the bank of the river and that therefore it owned the alluvion formation, and was entitled to the funds. The rival claimant contended that it had retained a strip of land between the river and that which it sold to the first claimant. The case was decided on a factual basis, the legal principle that alluvion belongs to a riparian owner being unquestioned. The lower court found that the first claimant owned all the way to the river bank and was therefore entitled to the funds. The Court of Appeals of Louisiana affirmed. (R. F. Williams-Fla) W69-00799

MANGROVE ISLANDS AND GROWTH AS LAND - FLOOD CONTROL DISTRICT TAXES.

James Kynes.
1964 Fla Att'y Gen Rep, No 064-61, May 13, 1964. 3 p.

Descriptors: *Mangrove swamps, *State jurisdiction, *Ownership of beds, Administrative agencies, Wetlands, Beds, Submerged plants, *Florida. Identifiers: *Trustees Internal Improvement Fund.

The question presented here was whether Mangrove Islands were submerged land or uplands; whether title thereto was vested in the State of Florida or in the trustees of the Internal Improvement Fund, and; what lands held by the Trustees within flood control districts were subject to flood control district taxes. The Attorney General replied that since mangroves could only live if their root systems were submerged by the average high tides, that such growths constituted submerged lands until such time as they gathered so much silt and sand as to be no longer covered by the average high tide, and the plants no longer remained green and growing. Since these were submerged lands, title was vested in the Trustees and would so remain even if the growths became uplands. FS 378.30 provides an exemption from flood control district taxes for bodies of navigable water and unclaimed waters which were meandered. The Mangrove Areas involved in this opinion were within such a meandered area, and consequently the Attorney General felt they should be exempt until they became uplands. (R. F. Williams-Fla) W69-00800

YOUNGSTOWN MINES CORPORATION V PROUT (OWNERSHIP OF LAKE BED).

124 N W 2d 328-354 (Minn 1963).

Descriptors: *Minnesota, Lakes, Boundaries (Property), *Lake beds, Lake shores, Navigation, *Ownership of beds, Low water mark, Navigable waters, *Mining, Legislation, State governments, Federal-state water rights conflicts, Riparian land, Legal aspects, Water law, Judicial decisions.

Youngstown, pursuant to Minn Statute 6.136, submitted to the Commissioner of Conservation a verified claim for refund of royalties it had paid the state under a mineral lease covering a portion of the bed of Rabbit Lake. The claim for refund was based on a provision of the lease respecting the ownership of the ores mined under it; the findings, conclusions, and judgment stipulated for in an action by the state to reform the lease; and a judgment, entered in a subsequent action, which determined that the state had no right, title, or interest in the bed of Rabbit Lake. The court held that clearly the state in entering into the lease with Youngstown acted not in its sovereign, but in its proprietary capacity, which subjects it to the same liability as other litigants. Under this lease, the state's right to receive royalties was conditioned upon its ownership of the lakebed. The case of State v Adams determined that the fee title to the lakebed was held by the riparian owners. The court affirmed the decision permitting Youngstown to claim the refund. (R. Smith-Fla) W69-00801

EMINENT DOMAIN: PUBLIC UTILITIES--CONSTRUCTING DAMS FOR WATER POWER.
State of Florida, Tallahassee.

Fla Stat Sec 361.02 (1967).

Descriptors: Dams, Eminent domain, Water power, Florida, Legislation, Condemnation, State government, Water law.

The statute grants the power of eminent domain to persons wishing to construct dams on watercourses in the State of Florida for the purpose of supplying water power for a public utility. This statute allows such persons to obtain land on the opposite side of the water course on which to abut his dam, and to obtain lands which will be flooded by construction of the dam. (Kirkconnell-Fla) W69-00802

D'ALBORA V GARCIA (OBSTRUCTION OF CANAL).

144 So 2d 911-916 (4 Cir Ct App La 1962).

Descriptors: *Navigable waters, *Ownership of beds, Riparian rights, Canals, Transportation, Water utilization, Water law, Legal aspects.

The plaintiff brought action to enjoin the defendant from obstructing a canal. The main question was whether the canal was navigable. The court held that evidence showing the use of the canal by boats for transportation and commerce proved the navigability of the canal. A test of the navigability of water bottoms is that those which are navigable in fact must be regarded as navigable in law, and they are navigable in fact when they are so used or susceptible to such use or are shown to be capable of commercial use. The defendant was enjoined from obstructing the navigable canal or impeding the use thereof. (Horner-Fla) W69-00803

PROTECTION OF PORTS AND HARBORS.
State of Florida, Tallahassee.

Fla Stat 309 (1967).

Descriptors: *Harbors, Tidal waters, *Docks, Bays, Rivers, Rocks, Gravels, Piers, Jetties, Piles (Foundation), Bulkheads, *Riparian rights, High water mark, Sands, Mud, Navigable waters, Fish, Bridges, *Florida. Identifiers: Ports, Wharves, Ballast.

This chapter of the Florida Statutes makes it unlawful to deposit any material in the waters of any bay, port, harbor or river of the state except as so provided. It also prohibits the deposit of any material on a wharf which may wash into the surrounding waters. This chapter provides for the deposit of clear stone and large rocks for use in the construction of wharves, piers, quays, jetties, or bulkhead. It also allows the deposit of any material behind permanent bulkheads which will not allow the material to flow into the protected waters. It goes on to list minimum standards for these bulkheads. Provision is made that nothing in this chapter will be construed to interfere with any rights or privileges previously enjoyed by riparian owners. Exception is also made to allow Escambia, Manatee, and Pinellas Counties to deposit such materials adjacent to bridges as are required to improve fishing. (R. H. Watson-Fla) W69-00804

WESTON DRILLING COMPANY V TUPPER (OIL LEAKAGE AND WATER POLLUTION).

139 So 2d 361-364 (Miss 1962).

Descriptors: Mississippi, Judicial decisions, *Water pollution, *Soil contamination, *Oil, *Pipelines, Pastures, Cattle, Streams. Identifiers: Ranches.

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

This case concerned water pollution caused by breakage of defendant's oil pipe line on land adjoining plaintiff's ranch. The defendants were held liable for being negligent in maintaining the pipeline and failing to prevent the damage to plaintiff after being notified of the oil leakage. The res ipsa loquitur doctrine was applied against defendant in holding it liable. (Crabtree-Fla)

W69-00805

TRUSTEES INTERNAL IMPROVEMENT FUND-AUTHORITY TO CONSTRUCT DOCKS, PIERS, WHARVES AND SIMILAR STRUCTURES,

Richard Ervin.

Rep Att'y Gen Fla 059-241 Nov 25, 1959.

Descriptors: *Florida, *State jurisdiction, State governments, Legislation, Navigable waters, Riparian rights, Ownership of beds, *Docks, Piers, *Coastal structures.

Identifiers: *Purprestures.

This opinion was requested by the director of the Trustees of the Internal Improvement Fund. He asked what authority the Trustees had in regard to the construction of docks, piers and similar structures in the navigable waters of the state, and if approval was required for each structure or if the Trustees could regulate such construction by the issuance of rules and regulations. The Attorney General replied that there is no statutory authority for riparian or littoral owners to construct docks or wharves into navigable waters, and also according to the common law a wharf was a purpresture, subject to sovereign control. Since the trustees are to administer and control all sovereignty lands, title to which is not vested in some other state agency, it is necessary for upland riparian owners to secure approval of the Trustees before constructing docks or wharves into navigable waters. The trustees may adopt rules and regulations for the construction of docks and wharves in particular areas, allowing their construction without individual permits. However, in the absence of such regulations, specific approval of the Trustees is necessary. (R. F. Williams-Fla)

W69-00806

PARKS V SIMPSON (SHELL DEPOSITS).

137 So 2d 136-141 (Miss 1962).

Descriptors: *Mississippi, *Judicial decisions, Oysters, Shoals, *Legislation, Dredging, Tidal waters, *Ownership of beds.

Identifiers: Public trust doctrine.

In a question turning on statutory construction, the Mississippi Supreme Court held that the provision in the 1960 seafood laws that the Mississippi Marine Conservation Commission, for the purpose of growing oysters, may acquire and dispose of shell seed oysters and other materials did not pertain to shell deposits of dead oysters. The commission acted ultra vires in entering a contract for the sale of shell deposits to which the state holds title as trustee for the people. By decree the court invalidated the contract and enjoined its performance. (MacMillan-Fla)

W69-00807

VAN SZYMAN V TOWN OF AUBURN (DRAINAGE - EASEMENTS).

188 N E 2d 453-460 (Mass 1962).

Descriptors: *Massachusetts, *Drainage, Surface drainage, Drainage effects, Drainage water, *Easements, Water law, Repulsion, Drainage systems.

Plaintiffs appealed from a decree which adjudged that the town of Auburn owns three easements of drainage into the plaintiffs' land, and that the owners of the adjoining land have an easement of flow in one of these drains. The plaintiffs bought

the parcel of land from the Whites in 1957. They knew of none of the drains prior to the purchase. The court discussed the facts surrounding each of the drains and concluded that concerning drain number 1 and 2, the Whites were not consulted about the installing of the drain, gave no written or oral permission at any time and never granted an easement to the town. The Whites created an implied easement of drainage appurtenant to the adjoining land and the plaintiffs may not block the flow of this drain. The court reversed the decree of the lower court. (R. Smith-Fla)

W69-00809

PUBLIC PROPERTY, TAXATION OF UPLAND ADJOINING SUBMERGED LANDS - RIPARIAN RIGHTS,

Richard Ervin.

Rep Att'y Gen Fla, 059-188, Sept 16, 1959.

Descriptors: *Riparian rights, Tidal waters, Legislation, *Beds, *Taxes, Legal aspects, *Florida, Administrative decisions.

Identifiers: Upland, Tax deed, Equity.

The Attorney General answered the question, where upland, adjoining submerged lands sold and conveyed by the trustees pursuant to Florida Statutes section 253.12 is taxed and a tax deed is issued pursuant thereto, without the taxation or sale of the said submerged lands, does the purchaser under the tax deed acquire riparian rights, in the negative. The Attorney General cited Caples v Taliaferro, 144 Fla 1, 197 So 861, for the rule that a riparian owner may separate his uplands from his submerged lands and convey both to different grantees or he may sell one and withhold the other. The owner of the submerged lands, notwithstanding the tax deed in question, has the right to fill his said lands. The purchaser under the tax proceeding has his remedy in a court of equity to determine his rights under the tax title. (R. H. Watson-Fla)

W69-00810

CHESARONE V PINWOOD BUILDERS INC (DRAINAGE SYSTEM).

186 N E 2d 712-716 (Mass 1962).

Descriptors: Eminent domain, Surface water, Damages, *Massachusetts, *Drainage system, Land development, *Artificial watercourses, Water law, Watercourses (Legal), Ditches, *Surface runoff, Rain water, Drainage, Drainage water, Flooding, Surface drainage.

This case dealt with a bill in equity to enjoin the defendants from discharging and throwing water in an artificial stream on the land of the plaintiff and for damages. In 1959 and 1960, the defendant developed his land for several hundred housing units. Defendant, with the approval of the planning board of Framingham and the permission of the town engineer graded his land so that it gradually sloped in a descending plane toward plaintiff's land. The defendant also installed a surface water drainage system which caused all of the surface water from the area to be collected into the drains and then discharged onto the plaintiff's land. The court granted plaintiff's request for damages on the basis that there never was any natural watercourse from defendant's land running over the plaintiff's land. The court found that the cost of correcting the condition by a proper drain under the plaintiff's land was \$28,130.60. There were other innocent parties involved and the court remanded the case for further investigation as to whether injunctive relief should be granted. (R. Smith-Fla)

W69-00811

REQUIREMENT FOR ESTABLISHMENT OF BULKHEAD LINE AS PREREQUISITE TO SALE OF SOVEREIGNTY OFFSHORE AREAS,

Richard Ervin.

Rep Att'y Gen Fla 059-217, Oct 27, 1959.

Descriptors: *Florida, *Islands, State governments, State jurisdiction, *Bulkhead line, *Coasts, Navigable waters.

This opinion was in response to a question from the Director of the Trustees of the Internal Improvement Fund. He asked if it was a necessary prerequisite to the purchase of unsurveyed offshore islands by private parties, that the purchaser first procure the establishment of a bulkhead about such island. The Attorney General replied that the purpose of the bulkhead provisions was to provide an exterior boundary beyond which no sales could be made and no filling take place. The establishment of a bulkhead is necessary, whether extensions into open water are contemplated or not. He concluded that the establishment of a bulkhead could be made a prerequisite to purchase of offshore islands from the Trustees of the Internal Improvement Fund. (R. F. Williams-Fla)

W69-00812

WINSTEAD V DICENZO.

185 A 2d 304-306 (RI 1962).

Descriptors: *Judicial decisions, *Rhode Island, *Riparian rights, Relative rights, *Docks, Legal aspects.

Identifiers: Injunctions.

Winstead, the complainant, owned land on the bank of a cove, and had erected a wharf out into the cove in connection with his fishing business. When another landowner (DiCenzo), on the same side of the cove, petitioned state officers for permission to build a similar wharf not far from Winstead's, he objected. Permission was granted over Winstead's objection, and he then sought an injunction against DiCenzo and the State officers to prevent construction of the wharf, on the grounds that such construction would permanently obstruct his access to his wharf. The lower court dismissed the suit and the Rhode Island Supreme Court affirmed. The court said that the mere finding of inconvenience to complainant did not constitute substantial deprivation of complainant's wharf, warranting an injunction. (R. F. Williams-Fla)

W69-00813

BRANCH V OCONTO COUNTY (CONDEMNATION).

13 Wis 2d 595 109 NW 2d 105-110 (1961).

Descriptors: Legislation, *Wisconsin, *Navigable waters, Eminent domain, State governments, Local governments, *Ownership of beds, Boundaries (Property), Riparian rights, *Condemnation, Right-of-way, Legal aspects, Beds under water, Ducks (Wild), Hunting, Water resources development, Game birds, Waterfowl.

The lake in question affords no fishing or swimming opportunities, but is excellent for duck hunting. Appellant Branch acquired the property surrounding the lake and only permits access to the lake for a fee. The county was able to purchase land from another owner for a road to the edge of Branch's property. The county board then voted to condemn a piece of land 50 feet wide across Branch's property. It was conceded that the board's purpose was to provide access to the lake for duck hunters. The State of Wisconsin holds the beds underlying navigable lakes in trust for the enjoyment of all its citizens and hunting is one of the recognized public purposes for which any navigable water may be used. The court affirmed the circuit court's decision upholding the condemnation action and denying Branch damages to compensate him for the loss of the right to exclude the public from the lake. (R. Smith-Fla)

W69-00814

FISCHER V MACHT (IMPROVEMENT OF A DITCH).

114 N W 2d 572-578 (Minn 1962).

Descriptors: *Minnesota, *Ditches, *Drainage, Tiles, Legislation, Legal aspects.

The case involved a petition under Minnesota Statute 106.501 for the improvement of a drainage ditch by constructing an open ditch to replace the original tile ditch. The petition was granted by the District Court. The appellants maintain that since the new ditch would depart from the old tile ditch at various points and take a sharply different course, it is not an improvement but a new open ditch, the establishment of which is governed by Minnesota Statute 106.031. The court held that the petition for improvement of an existing tile ditch by construction of an open ditch deviating at some points from the existing ditch but not involving drainage of any new lands, which met the requirements of 106.501 was sufficient. (Horner-Fla) W69-00815

BUFORD V UPTON (CONDEMNATION VALUE OF DAMSITE PROPERTY).
338 SW 2d 929-933 (Arkansas 1960).

Descriptors: Condemnation, *Condemnation value, *Eminent domain, Compensation, Water law, Judicial decisions, *Dam construction, *Arkansas, Dams, Damsites, Reservoirs, Cities, Reservoir sites, Land appraisal, Market value.

Because of a severe water shortage, the city elected to negotiate with a certain landowner to secure his property for the construction of a damsite to supplement the city's water supply. The owner granted the commission permission to take possession of the lands needed for the dam's construction, but when further negotiations failed to bring about an agreement on price the commission entered into condemnation proceedings. Compensation was accordingly set. On appeal the owner alleged that compensation was insufficient and that the value of the land should be based upon its availability as a damsite and reservoir. The City argued that the owner should not be allowed to value his property for the very purpose for which the city wished to condemn it. The court held that the owner had the right to obtain the market value of the land based upon its availability for the most valuable purpose for which it could be used, whether presently used for the purpose or not. The owner was correct, therefore, in requesting compensation based upon the market value of his land as a damsite, even though it was presently being used for agricultural purposes. (Kuder-Fla)
W69-00816

BOWLEY V KOZE (WATER EASEMENT).
30 Lehigh Co L J 55-63 (Pa Com Pl 1962).

Descriptors: *Easements, *Water rights, Land tenure, Water law, Legal aspects, *Wells, *Pennsylvania, Judicial decisions.

The plaintiff brought suit to force the defendant to supply water from a well on the defendant's land. The plaintiff had been using water from the well by virtue of an appurtenance clause in his deed. Due to the lowering of the water table, the well went dry. The defendant dug the well deeper at his own expense and added a pump. He then refused to supply water to the plaintiff. The court held that the plaintiff was entitled to the natural flow from the well as it existed before it was deepened and his rights could rise no higher than the use of the defendant's land for that purpose. If the water table were to rise again, the plaintiff could get the service renewed. The defendant could not interfere with the natural flow but the plaintiff had no right to anything more. (Horner-Fla)
W69-00817

SUNNY ISLES OCEAN BEACH CO V BENKE (OWNERSHIP OF BEDS).
126 So 2d 307 (3d DCA Fla 1961).

Descriptors: *Ownership of beds, Beds, Lakes, Real property, Riparian rights, Riparian land, Legal aspects, Water law, *Florida.

The plaintiff formerly owned the land surrounding a small lake. He sold the surrounding land but contended that he continued to own the lake bottom. The court held that the plaintiff's ownership of the lake when he held all of the abutting property did not remain in him when he sold the property surrounding the lake to others. (Horner-Fla)
W69-00818

GAVETTI V WATSON (LIABILITY FOR MAINTAINING ARTIFICIAL LAKE).
49 Del Co 240-252 (Pa Com Pl 1962).

Descriptors: *Judicial decisions, *Pennsylvania, *Confined water, Groundwater, Percolating water, *Percolation, Pervious soils, Seepage, Water law, Legal aspects, Damages.
Identifiers: Artificial lakes.

Plaintiff landowners brought suit against their neighbor, Watson, who owned land opposite a road, asking for an injunction and damages. The land naturally sloped from defendant's property to plaintiff's and plaintiff claimed that by enlarging an artificial lake on his property, defendant caused flooding and damage to plaintiff's property. The court found that the swampy, wet condition on the front of plaintiff's property was due to seepage through the dam at one end of the lake and under the road. This seepage was caused by the great water pressure exerted upon the dam and lake bottom by the volume of water contained in the lake, and such seepage was discontinued by drainage of the lake. The court held the defendant negligent because he built and maintained such a large lake without an impervious bottom, and granted the injunction and entered a judgment for damages. (R. F. Williams-Fla)
W69-00819

BANKS V MASON (ATTRACTIVE NUISANCE).

132 So 2d 219-222 (2d DCA Fla 1961).

Descriptors: *Swimming pools, *Drowning, Swimming, Ponds, Streams, *Florida, Artificial watercourses.
Identifiers: *Attractive nuisance doctrine, Trespass, Negligence, Artificial waterbodies.

The plaintiff's three year old son drowned in the defendant's pool and the plaintiff sought recovery under the attractive nuisance doctrine. The court discussed the doctrine and held that the owner of artificial lakes, fish ponds, mill ponds, gin ponds, and other pools, streams and bodies of water are not guilty of actionable negligence unless they are constructed so as to constitute a trap or unless there is some unusual element of danger lurking about them not existent in ponds generally. Swimming pools normally present no hidden danger and the plaintiffs did not allege that the pool constituted a trap or some unusual element of danger. Plaintiff's case was therefore properly dismissed. (Horner-Fla)
W69-00820

BLAKE V US (RIGHTS TO OYSTER BEDS).

295 F 2d 91-98 (4 CCA 1961).

Descriptors: *Navigable waters, *Federal government, *Ownership of beds, Navigation, Military aspects, Admiralty, Eminent domain, Water law, Legal aspects, Commercial fishing.

The libellants sued in admiralty to recover compensation for the taking of certain oyster beds leased by them in the bed of the York River in Virginia and for damages because of the removal of stakes and buoys in the oyster beds. The court held that the numerous stakes and buoys located in the natural navigable channel of the river were obstructions to navigable capacity and the removal of the obstructions was an improvement of navigation which served not only the purposes of the Navy but the members of the general public who made use of the

stream. So long as the general interests of navigation are served, it is irrelevant that special interests of the United States are also advanced. The U S was in the exercise of its dominant power to regulate and control navigation and was privileged to appropriate without compensation. (Horner-Fla)
W69-00821

SIESTA PROPERTIES INC V HART (OWNERSHIP OF LAND FORMED BY HURRICANE).
122 So 2d 218-224 (2d DCA Fla 1960).

Descriptors: *Accretion (Legal aspects), *Avulsion, *Ownership of beds, Boundaries (Property), Real property, Riparian rights, Riparian land, Gulf of Mexico, Hurricanes, Islands, Water law, Legal aspects, *Florida.

The plaintiff owned land on a peninsula off Siesta Key in the Gulf of Mexico. His land was directly across a pass from the defendant's land, located on the Key. A hurricane caused a part of the plaintiff's land to shift and fill in the pass between their property. In a suit to quiet title, the lands were held not to belong to either party. The lands were held not to be accretion and thus the defendant did not gain ownership of the property. The court further held that a landowner's property lines are not enlarged to an extent necessary to take in the new land formed when a part of his land is suddenly and perceptibly deposited upon or against the shore of another riparian owner or upon the bed of an intervening tidal pass belonging to the state. Boundaries do not change when the loss of land occurs by avulsion. Thus, the plaintiff lost the land when it strayed from his boundaries. (Horner-Fla)
W69-00822

BOROUGH OF FORD CITY, PENNSYLVANIA V UNITED STATES (NAVIGATION SERVITUDE AND MUNICIPAL PROPERTY).
213 F Supp 248-255 (DC Pa 1963).

Descriptors: *Navigable waters, *Federal government, Cities, *Eminent domain, Judicial decisions, Condemnation, Damages, Legal aspects, Ownership of beds, Watercourses (Legal), Riparian land, *Water law, Riparian rights.
Identifiers: *Navigation servitude.

Plaintiff brought an action for damage, based on a special act of Congress, for harm to plaintiff borough's sewerage system, brought about by construction of a lock and dam by the U S Government. Plaintiff claimed the damage was caused by the construction raising the ordinary high-water mark and pool level of the river. The court held that the system was private property within the Fifth Amendment, and thus the U S was liable for damage. Defendant claimed that it was not liable because the damage was caused in the course of an exercise of the navigation servitude. This doctrine allows the federal government to appropriate property without compensation when exercising its power over navigable waters in the interest of commerce. Exercise of this power below the high-water mark is not a taking of a private property right. In addition, if land above the high-water mark is damaged, value attributable to its riparian location is not recoverable. But the court found that the water was raised above the high-water mark, and that the riparian location of the injured property was not a factor in its value. (Patterson-Fla)
W69-00823

EXEMPTION FROM TAXATION OF AIR AND WATER POLLUTION FACILITIES.

For primary bibliographic entry see Field 05G.
For abstract, see .
W69-00824

TIEDEMAN V VILLAGE OF MIDDLETON (CITY'S DISCHARGE OF SURFACE WATER IN ACCORDANCE WITH NATURAL FLOW).
For primary bibliographic entry see Field 04A.
For abstract, see .

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

W69-00826

BEHM V KING LOUIES BOWL, INC (DRAINAGE OF SURFACE WATER).

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00827

CHAPPELL V WINSLOW (DIVERSION OF SURFACE WATER).

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00828

PENDLETON V STUTTGART AND KING'S BAYOU DRAINAGE AND IRRIGATION DIST (ATTEMPTED WITHDRAWAL FROM DRAINAGE DISTRICT).

360 S W 2d 750-753 (Ark 1962).

Descriptors: *Arkansas, *Judicial decisions,
*Drainage districts, Drainage effects, Legislation,
*Land tenure.

The Arkansas Supreme Court held that two landowners, who signed a petition for formation of a drainage and irrigation district, were not entitled to have their names removed. The remonstrants moved to have their names withdrawn only after a great deal of work had been done and expense incurred in connection with the project which, the court found, would benefit them indirectly. In the absence of claims of fraud, deceit or misrepresentation in obtaining the signatures, the signatures could not be removed at this point. (MacMillan-Fla)
W69-00829

DAY V MUMMEY (STORM DRAINS).

200 N E 2d 785-787 (1963).

Descriptors: Storm runoff, Surface runoff, Rain water, *Ohio, Floods, *Storm drains, Surface drainage, Cities, *Drainage systems, City planning, Diversion, Land development, Sewers.

This is an appeal on questions of law and fact from trial court's order enjoining the levy of special assessments for storm sewers against plaintiff's properties. The undisputed testimony was that since the installation of a 24 in. storm sewer in 1932, no flooding had occurred on Center Street. Counsel conceded that there had been no appreciable further development of the properties fronting on Center Street that would produce acceleration of water flow there. The court affirmed the decision and held that the claim depends essentially on the effects of acceleration and diversion of the uplands water flow as building occurs and hard surfaces and roof tops promote more and faster runoff at points upgrade from plaintiffs' properties. The individual lower property owner has no obligation to take any such increase of surface water where diversion and acceleration are factors. The city is precluded from assessing any portion of the cost of the 1958 storm sewer upon lands of plaintiffs because these lands were already provided with an adequate sewer. (R. Smith-Fla)
W69-00830

STEINEM V ROMNEY (TITLE TO SANDBARS WHICH GROW BY ACCRETION).

233 Md 16, 194 A 2d 774-778 (1963).

Descriptors: Maryland, Judicial decisions, *Sandbars, *Accretion (Legal aspects), *Ownership of beds, *Riparian land, Navigable waters, Recreation, Storm runoff, Storms.

This was an action with respect to title to a sandbar. The sandbar in question was initially completely submerged in a navigable river and has not attached to the river banks. Because of storms and changes in the river flow it grew by accretion. This

growth was lateral in nature so that the sandbar grew in front of plaintiff's property and finally attached itself to defendant's land, which was adjacent to plaintiffs land on the same side of the river. Defendant claimed title to the entire sandbar because it was attached only to his land and not to plaintiffs. It was held that plaintiffs held title to that accretion in front of their property because of their right of access to the river. (Crabtree-Fla)
W69-00831

REUTNER V VOUGA (DRAINAGE).

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00832

FURTEK V WEST DEER TOWNSHIP (CLOSING DRAIN RESULTING IN INCREASED SURFACE WATER FLOW).

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00833

MUNICIPAL LIQUIDATORS, INC V TENCH (AVULSION AND EROSION).

For primary bibliographic entry see Field 02L.
For abstract, see .
W69-00834

JACKSON V ATLANTIC COAST LINE R R (RIPARIAN'S RECOVERY FOR POLLUTION).

For primary bibliographic entry see Field 05C.
For abstract, see .
W69-00835

ARMSTRONG V WESTROADS DEVELOPMENT CO (SURFACE DRAINAGE).

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00836

UNITED STATES V PERMA PAVING CO (OBSTRUCTION OF NAVIGABLE RIVERS).

332 F 2d 754-758 (2nd Cir 1964).

Descriptors: New York, Judicial decisions, *Navigable rivers, *Riparian land, *Land fills, *Mud flows, Bank erosion, Shore protection, Damages, Dredging, Obstruction to flow.
Identifiers: Bronx River.

This was an action by the United States to recover costs it had incurred in dredging from the navigable channel of the Bronx River a shoal which resulted from the misuse of riparian land owned by New York City. The city permitted its lessee to use land along the river as a storage for fill. The city determined that twenty feet of fill could be supported by the land. However, the filling operation caused the riparian land to slide into the navigable channel of the Bronx River. The United States removed the mud slide and recovered costs from the city and from the lessee. (Crabtree-Fla)
W69-00837

PETERS V SHULL (COLLECTION AND DISCHARGE OF SURFACE RUNOFF).

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00838

STEVENS V MAYO (OWNERSHIP OF ACCRETION).

166 So 2d 572-575 (4th Cir Ct App La 1964).

Descriptors: *Accretion (Legal aspects), *Ownership of beds, Beds, Riparian rights, Riparian lands, Real property, Boundaries (Property), Navigable water, Water law, Legal aspects, *Louisiana.

The plaintiff brought petitory action against the defendant, who was in possession of a batture on the Mississippi River. The batture was conveyed to the defendants' predecessor in title and later the riparian lot on the river was conveyed to the plaintiff's predecessor in title. The plaintiff claimed that future accretions could not be conveyed, that the batture did not exist at the time of the conveyance to the defendants predecessor, and that the batture belonged to him as accretion to his land. The court held that even if future accretions cannot be sold separately from the riparian estate, the plaintiff did not prove the non-existence of the batture at the time of the sale. (Horner-Fla)
W69-00839

SPICER V WHITE BROS BUILDERS INC (DRAINAGE SYSTEMS).

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00840

HUGUENOT YACHT CLUB V LION (UNDERWATER AND RIPARIAN RIGHTS OF ADJOINING UPLANDS OWNERS).

43 Misc 2d 141; 250 N Y S 2d 548-556 (1964).

Descriptors: *New York, *Judicial decisions, *Riparian rights, Competing uses, *Marinas, Docks, Bulkhead line, *Boundary disputes, Navigable waters.

A yacht club sought to enjoin a commercial marina boatyard operator from using a floating dock near the club's dock and for removal of the floating dock on grounds of zoning ordinance violation and of trespass upon club's underwater and riparian rights. A prior action established that there was no zoning ordinance violation, the defendant possessing the right to continue to use his land for a boatyard as a non-conforming use the structure complained of being incident to that use. The Supreme Court determined that club and operator had established their common underwater boundary as being their upland property line extended to the bulkhead line. Under law of riparian rights, prior construction and long use of a dock gave the club no right to continue use of the west side of dock or to prevent operator from making full use of his riparian rights by construction of a float on any part of lands under water in front of his upland. (MacMillan-Fla)
W69-00841

COMMONWEALTH V HENDERSON COUNTY (DEPLETION RIGHTS UNDER RIVER BED).

371 S W 2d 27-35 (Ky, 1963).

Descriptors: Ohio River, *Ownership of beds, *Patents, *Leases, Oil, Natural gas, Public lands, Boundaries (Property), Local governments, State governments, *Withdrawal, Kentucky, Low water mark, Rivers, Beds.

The discovery of oil and gas under the bed of the Ohio River between the thread of the stream and the Indiana shore gave rise to this case. Claimants to these rights are: the counties bordering the area and their lessees; those claiming under state patents; and claimants under a lease executed by the State Property and Building Commission. The border of Kentucky extends to the north or northwest low water mark of the Ohio River while an individual Kentucky landowner only owns to the thread of the river. The state controls the northern or northwestern side of the river and its disposition of these rights involves three statutes: the Patent Statutes; the County leasing Statute; and the Building Commission Statute. It was held that the patentees of this land had no claim because this portion of the state's land was not encompassed by 'vacant and unappropriated' land referred to in the Patent Statute. Lessees of the Building Commission also do not take because the statute does not expressly repeal the counties' historical control over these lands. County lessees do take as the right to ex-

ecute depletion leases is implied from the statute.
(McDermott-Fla)
W69-00842

MUNN V HORVITZ CO (PRESCRIPTIVE RIGHTS).

For primary bibliographic entry see Field 04A.
For abstract, see .
W69-00843

MIANUS REALTY COMPANY V GREENWAY (RIPARIAN RIGHTS).

193 A 2d 713-716 (S Ct Err Conn 1963).

Descriptors: High water mark, *Riparian rights, *Boundaries (Property), Navigable waters, Watercourses (Legal), Water law, *Connecticut, Bulkheads, Marinas, Tidal marshes, Land reclamation, Ownership of beds.

This action involves a parcel of land on the easterly side of a cove on the Mianus River. In 1937, the railroad owned the cove and Greenway owned the land on the westerly side. Both parties then had full riparian rights in and to the land below the high water mark in front of their respective premises. Greenway and the trustees of the railroad entered into a written agreement establishing a division line between their properties beyond which neither party would claim riparian rights or make land by filling in. This line was delineated on a map attached to the agreement. The title passed through various persons and is presently in Harrison. The court examined the deeds granted from the railroad and concluded that the present owner had no riparian rights since the land had been filled and a bulkhead erected on the 'Line of Ultimate Filling' as delineated on the map. (R. Smith-Fla)
W69-00844

REINHART V LANCASTER AREA REFUSE AUTHORITY (WELLS-WATER POLLUTION).

201 Pa Super 614, 193 A 2d 670-676 (1963).

Descriptors: *Pennsylvania, Wells, *Water wells, Streams, Groundwater, Water table, Inflow, Percolating water, *Water pollution, *Waste dumps, Liquid wastes, Land, Garbage dumps, Pollutant identification, Reasonable use, Judicial decisions.

This action arose as a result of filling operations on land owned by defendant McFalls and leased by him to the other defendant, Lancaster, for the purpose of dumping refuse thereon. Plaintiffs are appealing the grant of a judgment n o v for the defendants following verdicts for money damages in plaintiffs' favor in two actions of trespass brought for contamination of wells located on their respective properties. The court here reversed the judgment and held that the defendants, in bringing polluted material, particularly items such as garbage, red paint, etc., which might permeate the earth and resist filtration, failed to use due care in handling such material when they placed it in close proximity to plaintiffs' land and wells, of which they were aware, and into excavations they had made below the surface of the land, even below the water level of a stream running through the land, and then compressing it into the ground by running trucks over it. Since they had received general warnings about the results of this operation, the effect on the percolating waters was reasonably foreseeable. (R. Smith-Fla)
W69-00845

CRUTCHER V CRAWFORD LAND COMPANY (LEGISLATION).

138 S E 2d 580-584 (Ga 1964).

Descriptors: Water law, Surface water, Land development, Surface drainage, *Legislation, State governments, Surface runoff, *Georgia, Judicial decisions.

This is an alleged trespass and damage suit case resulting from the alleged increasing of the flow of surface water upon the property of the plaintiff by the defendants. The case dealt on a procedural point concerning the 'voluminous petition' submitted here which named several defendants and in the most general terms charged numerous acts without causal connection or common wrong. The court here affirmed the lower court's decision granting a summary judgment in favor of the defendant. It was held, inter alia, that allegations of cutting trees, debris and underbrush and excavating and landscaping land, thereby increasing the flow of surface water on plaintiff's land, were insufficient, as defendants had a right to do all these things to their respective properties. (R. Smith-Fla)
W69-00847

HIGH KNOB, INC V ALLEN (WATER CONTRACT).

205 Va 503; 138 S E 2d 49 (1964).

Descriptors: *Judicial decisions, *Virginia, *Water contracts, Contracts, Supply contracts, Domestic water, Water supply, *Water works.

Allen entered into a written sales contract with High Knob, Inc, to purchase a residential lot. It was provided in the deed that no method of taking water from the ground could be used. There was an oral agreement that High Knob would allow Allen to hook on to its water system for a \$200 fee. Allen then constructed a home and hooked on to the water system. However, the company refused the \$200 payment and provided a contract with other terms than the oral agreement. When Allen refused to sign, his water service was cut off. Allen sought a permanent injunction to force the company to comply with the terms of the oral agreement. After dealing with various parol evidence problems, the trial court granted the injunction. High Knob appealed and the Supreme Court of Appeals of Virginia affirmed, holding that the company had to furnish Allen with a reasonable quantity of water. (R. F. Williams-Fla)
W69-00848

NANCE V TOWN OF OYSTER BAY (TITLE TO SUBMERGED LANDS).

244 N Y S 2d 916-926 (1963).

Descriptors: *Judicial decisions, *New York, *Ownership of beds, Beds under water, Navigable waters, *Bays, Dredging, Proprietary power.

Identifiers: *Trespass.

This case involved a controversy over title to the bed of Cold Spring Harbor. The Town of Oyster Bay, on the one side, and the Town of Huntington on the other, both claimed title to such bed, and the U S Dredging Company claimed that title was in private owners. The company, under a contract with Huntington dredged the bottom of the Harbor. Oyster Bay, through taxpayer, brought an action in trespass against Huntington and the company. The court found it necessary to construe the old colonial charters to decide if they granted title to underwater land. In regard to the company's claim, it found that since there was no presumption that deeds to uplands carry title to submerged lands, in the absence of express words to such effect in deeds from Oyster Bay, title to submerged lands never passed to private owners. The original grant to Huntington extended only to the high-water mark on its side of the bay. The court then proceeded to hold that prior decisions had established title to the bottom of the bay in Oyster Bay and the company had trespassed thereon. (R. F. Williams-Fla)
W69-00850

GRANTS TO RIPARIAN OWNERS.

Fla Stat Ch 271 (1967).

Descriptors: *Florida, Oysters, *Riparian rights, Ownership of beds, Beds under water, Boundaries (Property), *Legislation, Water law, Legal aspects, State governments, Highwater mark, Navigable waters, Riparian land, Relative rights, Low water mark, Channels.

Riparian rights are those incident to land bordering upon navigable waters. They are the rights of ingress, egress, boating, bathing, fishing and such other rights as may be defined by law. Such rights are not of a proprietary nature and are appurtenant to and inseparable from the riparian land. The trustees of the internal improvement trust fund are authorized to grant to riparian owners perpetual easements, or easements, licenses and leases for a specified term of years permitting such riparian owners to construct and maintain structures on, in and under the bed of any navigable stream or river owned in whole or in part by the state. This chapter does not apply to lakes except tide water lakes and nothing contained in it should be construed as a release of the title of the state or any of its grantees to any swamp or overflow lands. The state reserves the ownership of all natural oyster beds upon and all minerals and oils in the submerged lands until they are filled in and improved by the riparian owners. (R. Smith-Fla)
W69-00851

BROWN V ALABAMA POWER CO (OBSTRUCTION TO FLOOD EASEMENT).

156 So 2d 153-157 (Ala 1963).

Descriptors: *Judicial decisions, *Alabama, *Easements, Floodwater, Obstruction to flow, Relative rights, Legal aspects, Water law.

Identifiers: Injunctions, *Easement to flood.

Plaintiff Alabama Power Corp purchased a tract of land in fee simple and also purchased an easement to flood adjacent land from the same parties. Subsequently plaintiff's grantors sold the adjacent land, subject to the easement, to defendants. The defendants constructed a dwelling house and proposed to fill a portion of the land to exclude flood water therefrom. Plaintiff sought an injunction to forbid defendant from constructing and maintaining the dwelling house and from interfering in any other way with plaintiff's easement over the property. The trial court granted the decree prayed for, and the Alabama Supreme Court affirmed. A person who takes land subject to an easement must not interfere with dominant owner's enjoyment of such easement. If such were allowed, the servient owner could nullify the easement. (R. F. Williams-Fla)
W69-00854

CONSTRUCTION OF SEC 253.0013 (2) F S, Florida, Office of the Attorney General, Tallahassee.

Richard Ervin.

Rep Fla Att'y Gen 060-111, June 30, 1960.

Descriptors: *Florida, Bulkhead line, Navigable water, *Landfills, Land forming, State jurisdiction, Legislation, Federal government, *Administrative decisions, Public rights, *Permits.

Identifiers: Florida Bulkhead Law, Corps of Engineers.

This opinion was in response to five questions from the Director of the Trustees of the Internal Improvement Fund which were concerned with construction of Fla Stat 253.0013 (2). That statute authorizes an exception to the application of the bulkhead law for persons who hold fill permits granted by the U S Corps of Engineers prior to June 11, 1957. The Attorney General replied that since this was an exception to a statute, it must be strictly construed, and that the holder of an unexpired U S permit, who is otherwise qualified under 253.0013 (2) may fill without advertisement for objections as required by the bulkhead law. A U S permit expired or extended subsequent to June 11, 1957 does not meet the requirements of the exception. Changes in bulkhead lines after June 11, 1957 will not affect

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rights under U S fill permits, and such permits are not personal to the holder, but run with the land. Any change in the provisions of the permit, such as extention of time or area covered, will disallow the holder of such permit to be exempted from the requirements of the bulkhead law. (R. F. Williams-Fla)
W69-00857

CONOLEY V NAETZKER (TITLE CHALLENGE TO RECLAIMED LAND).

137 So 2d 6-10 (2d D C A Fla 1962).

Descriptors: Judicial decisions, *Florida, Riparian rights, *Reliction, Accretion, *Boundaries (Property), *Land reclamation, Dry beds, Lakes, Drainage effects, Drainage wells, Navigable waters.

Judgment for plaintiffs in an ejectment action was affirmed on appeal. The land in question was a lake bottom and the cause was mainly tried on the issue of what had caused the lake to recede. The defendants claimed title by the doctrine of reliction, asserting that the water receded gradually and the land thus formed a natural accretion to the land to which they hold title. The plaintiffs' contention was that the recession of the waters was perceptible and accomplished by drainage, thereby rendering the lake bed reclaimed land which vested in the state. The court, not reaching the question of reliction, affirmed the lower court's ruling that the finding by the Trustees of the Internal Improvement Fund that the subject land was reclaimed lake bottom was not subject to collateral attack in a suit between private parties in the absence of a showing of an abuse of discretion or that defendants were never afforded an opportunity of making a direct attack on the sale. (MacMillan-Fla)

W69-00858

TRUSTEES OF THE I. I. FUND - SALE OF SUBMERGED LANDS.

Florida, Office of Attorney General, Tallahassee.
Richard Ervin.

Rep Att'y Gen Fla 059-1, Jan 1, 1959.

Descriptors: Channels, *Bulkhead line, *Spoil banks, Beds, Riparian rights, Legislation, Islands, Access routes, Artificial watercourses, Sand bars, Navigable waters, High water mark, *Tidal waters, *Florida.

The Attorney General gave opinions to two questions. The first question was does a bulkhead line established so that it precludes 'A' from filling adjacent to his upland permit 'B', an adjoining upland owner who is not so precluded, to purchase that part of a spoil bank which extends in front of 'A's' upland. This question was answered in the negative. The bulkhead act gives only the upland owner a preference to purchase the submerged land riparian to his upland, i.e., that lying between his upland and the channel. Adjoining upland owners have no more preference than the general public to purchase this land. The second question was may a spoil bank, separated from the mainland by an artificial channel, be sold at competitive bids rather than to the upland owner. The Attorney General answered in the affirmative, stating that when an artificial channel has existed for a number of years, it establishes the limits of riparian rights. Thus the trustees of the internal improvement fund may sell at competitive bids those submerged lands which are separated from the mainland by artificial channels. (R. H. Watson-Fla)

W69-00861

ADOPTION OF CHANGE OF BULKHEAD LINE BY MUNICIPALITY SINCE EFFECTIVE DATE OF SECTION 253, FLA STAT.

Florida, Office of the Attorney General, Tallahassee.

Richard Ervin.

Rep Att'y Gen Fla 059-176, Sept 3, 1959.

Descriptors: Legislation, *Bulkhead line, *Cities, *Riparian rights, *Florida.
Identifiers: Charter, County commissioners.

The question asked of the Attorney General was, 'May a municipality, under charter provisions in force and effect when sec 253.122, F S, was enacted, adopt or charge a bulkhead line without complying with said section.' The Attorney General's opinion was that the above question should be answered in the negative, unless the municipality had been relieved from complying with sec 253.122, by legislation adopted subsequent to June 11, 1957. (R. H. Watson-Fla)

W69-00863

PETITION OF SUFFOLK COUNTY WATER AUTHORITY (POWER OF THE WATER POWER AND CONTROL COMMISSION).

12 App Div 2d 198, 209 NYS 2d 978-982 (1961).

Descriptors: Judicial decisions, *New York, *Water supply, *Administrative decisions, *Administrative agencies, Water districts, Public utilities districts, Competition, Regulation, Relative rights, Public utilities, Cities.

Two public water supply agencies sought future service of the same territory. The legal right of the Water Power and Control Commission to rearrange its formal approval and authorization to provide water service given to petitioner Suffolk County Water Authority was challenged. Petitioner had notice of an intention by the Town of Huntington to service an area within the town which petitioner sought to serve, and clear objection by the town to petitioner's application to serve this area. Added to this was an explicit reservation by the Commission in its approval of petitioner's application to the effect that the Commission might exercise adversely to petitioner a 'right to alter the boundaries of the area' and to grant 'other' authorizations in the same territory. These reservations referred to the activities of the Town of Huntington noted in the same proceedings in which petitioner obtained its authorization. This was followed shortly by the town's action seeking legal status to extend the territory of its water district. The court held that petitioner had not demonstrated that the Commission's decision was unjust, inequitable, arbitrary, or capricious, and confirmed the determination. (Smodish-Fla)

W69-00865

GELLENTHIN V J AND D INC (DAMAGES FROM WATER RUNOFF).

71 N J Super 226; 176 A 2d 515-520 (1961).

Descriptors: *Runoff, *Reasonable use, *Alteration of flow, Repulsion (Legal aspects), Drainage water, *Surface runoff, Easement, Legal aspects.

The plaintiff was injured while walking on a public sidewalk when he slipped on ice that had been formed from water running off the defendants property. The court held that the 'reasonable use' doctrine was applicable. Each possessor is legally privileged to make a reasonable use of his land, even though the flows of surface waters is altered thereby and causes some harm to others, but incurs liability when this harmful interference with the flow of surface waters is unreasonable. The issue of reasonableness is a question of fact to be determined in each case upon a consideration of all relevant circumstances. The court affirmed the judgment for the defendant. (Horner-Fla)

W69-00866

PEOPLE V BROEDELL (OWNERSHIP OF LAND).

365 Mich 201, 112 N W 2d 517-520 (1961).

Descriptors: *Ownership of beds, *Submerged Lands Act, *Beds, Low water mark, High water mark, Boundaries (Property), Water level fluctua-

tions, Real property, Patents, Riparian rights, Riparian lands, Legal aspects.

The case involved a dispute over the ownership of two lots on Lake St Clair. The State claimed that the lots, which had been filled in by the defendant, were submerged lands in 1837 when Michigan was admitted to the Union and thereupon became the property of the state through the Submerged Land Acts. The court said that the decision was not controlled by the high water mark or the low water mark theory or by the philosophy of a movable freehold. It held that if the lots were within the boundary of a land patent from the U S to the defendants predecessor in title, dated 1811, no title passed from the U S to the State of Michigan upon its admission to the Union in 1837, even if the lands were submerged at that time, because it then no longer belonged to the United States but to the successors of the original grantee. The court remanded the case for the trial court to make a finding on the question whether the lots were within the description of the patent. (Horner-Fla)

W69-00868

TONKINS V MONARCH BLDG MATERIAL CORP (NAVIGABILITY OF A STREAM).

347 S W 2d 152-158 (Mo 1961).

Descriptors: *Missouri, Judicial decisions, Damages, *Streams, Streambeds, Ownership of beds, *Navigable waters, Non-navigable waters, Riparian rights, Boundary disputes, Boundaries (Property).

Plaintiff alleged that defendant corporation had wrongfully removed sand from the portion of a river bed lying between plaintiff's bank and the thread of the stream. Plaintiff contended that the river was non-navigable where it passed his property, and therefore he owned the river bed as well as the bank at that point. The defendant denied that (1) the river was non-navigable; and (2) it had removed sand and gravel on the plaintiff's side of the thread of the stream. This court affirmed the verdict for defendant. Since the plaintiff alleged that the river was non-navigable, it was his burden to prove it. Each determination as to navigability must rest on the facts of the particular case. A stream need not be navigable in its entirety to be classified as navigable. Navigability must be determined by the capability for use by the public for transportation and commerce, rather than the particular extent and manner of that use. (Blunt-Fla)

W69-00869

BERNARD V STATE (SUIT TO RECOVER VALUE OF LAND TAKEN FOR PUBLIC PURPOSE).

127 So 2d 774-781 (Ct App La 1961).

Descriptors: *Drainage, *Ditches, *Eminent domain, Damages, Appropriation, Canal construction, State governments, Excavation, *Louisiana, Judicial decisions, Condemnation, Compensation. Identifiers: Public purpose, Servitude, Police power.

Court of Appeals affirmed the trial court's award of damages for the taking of a portion of plaintiff's land for a drainage ditch. The ditch was along the edge of plaintiff's land bordering a public road. Damages were awarded for the value of the land appropriated, cost of constructing a bridge to the road, and decrease in the value of the property. Although the state cannot be sued without the consent of the legislature, if it appropriates land by eminent domain it must pay just value of the land. The appropriation of plaintiff's property for the drainage ditch did not constitute the exercise of the state's police power entitling the state to take such property without compensating the owner. The state was not entitled to be decreed the owner of the property used, but was entitled only to a servitude for drainage purposes over that portion of the property affected by the actual excavation. (R. H. Watson-Fla)

W69-00871

MCKNIGHT V BROEDELL (TITLE TO RIPARIAN LAND).

212 F Supp 45-53 (D C Mich 1962).

Descriptors: *Ownership of beds, *High-water mark, Boundaries (Property), Real property, Federal government, State governments, Navigable waters, Water law, Legal aspects, Grants.

As a defense to an action for payment on a contract to purchase riparian land, the defendant claimed the title was unmarketable because the State claims ownership of a portion of the land. The land in question borders Lake St. Clair and part of the land is within the ordinary high water mark of the lake, having been filled in subsequent to 1923 thereby converting it into land suitable for building purposes. The question is whether the original grant from the U S to one Abbot in 1810 included the land claimed by the state or whether the grant to Abbot only included land to the ordinary high water mark of the lake. If the latter, then the title to the bed of the lake below the high water mark went to the State upon its admission to the Union. The court held that it was a factual question whether the lake had risen and covered the land in question since 1810 or the original surveyor had erred. Since a purchaser is not required to buy land which he might later have to defend title to, the title was unmarketable. (Horner-Fla)
W69-00872

JONES V HOGUE (APPORTIONMENT OF ACCRETION).

129 So 2d 194-203 (La 1960).

Descriptors: *Accretion (Legal aspects), *Boundaries (Property), Real property, Riparian land, Riparian rights, Water law, Legal aspects, Ownership of beds, Navigable water, Boundary disputes, *Louisiana.

The court was asked to apportion an alluvial formation that had formed in front of the riparian property of the parties. When alluvion formed in front of the estates of riparian owners is to be divided, two objects are to be attained: (1) each owner should receive a fair proportion of the area; and (2) each should receive a fair proportion of the new frontage on the water. The court must take each case as presented and order an apportionment by the method which will most nearly attain the two objects and do justice to the parties. In this case, there was no showing that river frontage had any importance for commerce or navigation, so the court used an area method of apportionment. The alluvion was divided to give each party that portion of the entire area (as it existed at the time the action was instituted) as the length of the original front line of their property bears to the length of all the property to which the alluvion was attached. (Horner-Fla)
W69-00873

AN ACT PROVIDING A PENALTY FOR WELL DRILLERS WHO FAIL TO SUBMIT A REPORT TO THE WATER RESOURCES COMMISSION UPON COMPLETION OF EACH WELL.

Connecticut Public Act No 735 (1967).

Descriptors: *Connecticut, *Well regulations, Well permits, *Water wells, Wells, Drilling, Water law, Legal aspects, Legislation, State governments, Administrative agencies, Subsurface waters, Public health.

Section 25-9 of the 1965 supplement requiring registration of well diggers, the acquisition of permits, and the submission of a report when a well is completed is expanded. The addition provides that if the Water Resources Commission ascertains that a report has not been submitted within sixty days after the completion of a well, the Commission shall notify the driller that he must forfeit \$25. (Horner-Fla)
W69-00875

AN ACT TO AMEND 29.05 (1) AND TO CREATE 30.125 OF THE STATUTES, RELATING TO CUTTING WEEDS IN NAVIGABLE WATERS AND PROVIDING A PENALTY.

Wisconsin Laws of 1967, Ch 185.

Descriptors: Legislation, *Wisconsin, *Weeds, *Navigable waters, Lakes, Lake shores, *Remedies, Floating, State jurisdiction, State governments, Administrative agencies.

The State of Wisconsin has made it a nuisance to cut and fail to remove weeds from navigable waters. Violators may be penalized by fine, imprisonment or both. This shall not apply, however, where lake property owners, incorporated under specified statutes, decide at an annual meeting that every such property owner shall remove weeds floating to his respective shore. The State Conservation Commission and its deputies are authorized to enforce this law. (Geraghty-Fla)
W69-00877

WICKOUSKI V SWIFT (USE OF POND SURFACE).

203 Va 467; 124 S E 2d 892-895 (1962).

Descriptors: *Ownership of beds, *Riparian lands, *Riparian rights, Beds, Ponds, Lakes, Surface waters, Boundaries (Property), Dams, Water utilization.

The complainant sought to enjoin the defendants from using the surface of his portion of a fresh water lake. The question was whether the complainant had exclusive control and use over his portion of the bed of the pond and had a right to erect a fence on his boundary line across the pond. The court distinguished between a situation where the riparian owner's property was bounded by a pond and one where each owner owned a part of the submerged land beneath the pond. In the former situation, each owner has title to the bed to the middle of the pond and each owner may use all of the surface water. In the latter situation, as in the case at hand, the owner of a portion of the bed with distinguishable boundaries is entitled to exclusive control and use of the waters above his portion and has the right to erect a fence. (Horner-Fla)
W69-00878

TRUSTEES OF GREEN BAY LEVEE AND DRAINAGE DISTRICT NO 2, LEE COUNTY V ALEXANDER (REASSESSMENT OF DRAINAGE DISTRICT).

108 N W 2d 593-601 (Iowa 1961).

Descriptors: *Iowa, Civil law, *Drainage districts, Judicial decisions, Leases, Contracts, *Assessments, Levees, Ditches, Drains, Taxes.

When the drainage district was being established, the defendants' predecessors in title filed remonstrances against the establishment of the district, basically on the ground that their lands would not be benefited by the creation of the district. In consideration of their concessions, the contract establishing the mutual district provided that the defendants' predecessors in title were to be assessed only for levees, ditches and drains wholly on their lands and an additional five cents per acre annually for maintenance after completion of construction. Forty-two years later, the trustees of the district passed a resolution requiring reclassification of all land subject to assessment in the district. The trustees, plaintiffs here, petitioned the court for a declaratory judgment permitting them to reclassify the land in excess of five cents per acre annually, according to benefits received. The court denied the petition and held that the contract of predecessors of title of both plaintiffs and defendants was binding on them, and the fact that some of the land has been subsequently transferred by means of a tax title was not a change in circumstances that would free the trustees of the district from prior restrictions or covenants. The establishment of a mutual drainage district by contract did not violate a prohibition against any lease or grant

of agricultural land for over twenty years. (S. Scott-Fla)
W69-00887

DRAINAGE COMMISSIONERS OF HAMMOND MUTUAL DRAINAGE DISTRICT V PONDER (ANNEXATION BY DRAINAGE DISTRICT).

20 Ill 2d 351, 169 NE 2d 784-787 (1960).

Descriptors: Administrative decisions, *Illinois, Civil law, *Drainage districts, Judicial decisions, Drainage programs, *Assessments, Tile drainage, Ditches, Drainage engineering.

Identifiers: Farm Drainage Act.

The drainage commissioners of a mutual drainage district passed a resolution charging landowners within the district with an additional assessment for repairs, maintenance and operation of the drainage system. The appellant objected to the assessment against her property, claiming that her property did not drain into the ditches of the district, and that neither she nor her predecessors in title had agreed to include the land in the drainage district. The court found that improvements on the appellant's property drained naturally and by tiles into the district drains. The construction and connection of drains from appellant's land into the district drains and the resulting benefit to the land effectively annexed it to the district. It is lawful for the commissioners of a drainage district to require additional assessments to repair, maintain, operate or improve the drains and other works of the district without prior authorization of the court, provided it does not involve a substantial or material enlargement or alteration of the system. (S. Scott-Fla)
W69-00890

BOROUGH OF ISLAND HEIGHTS V PRESBYTERIAN CAMPS AND CONFERENCES, INC (ASSESSMENT OF SUBMERGED LANDS).

68 NJ Super 291, 172 A 2d 228-231 (1961).

Descriptors: *New Jersey, Civil law, Judicial decisions, Beds, Riparian land, *Riparian waters, Landfills, Reclamation, Riparian rights, Beds under water, *Ownership of beds, *Assessments, Taxes.

Respondent owns upland, tax-exempt property. Adjacent to this upland property respondent holds underwater property under a grant from the State of New Jersey, with the right to fill in such underwater land and retain it for its exclusive private use. The Borough of Island Heights separately assessed the riparian rights for taxation. The court affirmed this assessment on the ground that the respondent had legal title to the lands under a riparian deed from the state. Respondent's ownership was not limited to a right to reclaim and fill in such lands that would not ripen into ownership until the right was exercised, but rather was in the nature of a fee, with no ownership remaining in the state. (S. Scott-Fla)
W69-00892

TRUSTEES OF INTERNAL IMPROVEMENT FUND V LOBEAN (SALE OF SUBMERGED LAND).

127 So 2d 98-104 (Fla 1961).

Descriptors: *State governments, *Judicial decisions, *Beds, Taxes, Legislation, High water mark, *Florida.

Identifiers: Estoppel by deed, Deeds, Equity.

Plaintiff sought to enjoin Trustees from selling submerged lands under FS 253.12 which had previously been conveyed erroneously to the plaintiff under the Murphy Act. The Murphy Act authorizes the state to sell land with delinquent property taxes in order to keep the land on the tax rolls. The state could not sell the land in question under the Murphy Act because it was submerged land which was not subject to a property tax. The Trustees of the Internal Improvement Fund were legally

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

estopped by deed from denying the validity of the Murphy Act deed to submerged land, in absence of circumstances sufficient to prevent operation of legal estoppel against the state. (R. H. Watson-Fla) W69-00895

95-1401 RIGHT OF WAY, DAMAGES FOR, 95-1402 GRANTS OF LAND, 95-1403 GRANTS FOR FERRY, 95-1404 VALUE OF LAND, HOW ESTIMATED.

95 Ga Code Ann Secs 1401-1404 (1967).

Descriptors: *Georgia, Eminent domain, *Grants, *Condemnation value, Condemnation, Bridges, State jurisdiction, Legislation, Land appraisal, *Right-of-way.

Sec 95-1401 provides that the damages for rights of way are to be assessed in the same manner as for public roads and private ways. Sec 95-1402 provides that grants of land on watercourses, with the appurtenances, convey no right to establish a public bridge or ferry. Sec 95-1403 provides that the grant of a ferry franchise conveys no right to build a bridge, or the converse. Sec 95-1404 provides that in determining the value of land taken for a bridge, its prospective value as a bridge site and its present value as a ferry, if one is in use, may be taken into account in determining compensation due. (R. F. Williams-Fla)

W69-00903

WISE MANAGEMENT OF NORTH CAROLINA WATER RESOURCES THROUGH LAW.

North Carolina Department of Natural Resources, Raleigh.

North Carolina Board of Water Resources Final Report, pp 1-53, April 1967. 54 p, 7 ref, 7 append.

Descriptors: *North Carolina, Federal government, *Legislation, Well permits, *Well regulations, Water conservation, Water control, Water demand, Water consumption, *Water resources, Water rights, *Watersheds (Basins), Water storage, Water table.

This report on the need for water legislation is the final report in response to directions issued by the 1965 General Assembly of North Carolina. The instructions given specified a study of the need for state regulation of water usage. This report is based on hearings held in each part of the state. The major Board finding is that a need for water use control exists in NC and a number of geographical areas face a significant potential need for early application of controls. The areas are then identified. The remedies proposed by the Board include legislation to provide: (1) A procedure to identify areas where water demands and problems require special action, a system to establish specially designed controls for these areas to include use permits, and provisions to assure due process; (2) A procedure for coordination of use of raw water supply sources so that maximum storage for public water supply may be included in federal projects; (3) A system of reporting water use; (4) Standards for well construction, abandonment, permits for large wells, etc; (5) Dam safety and coordination; (6) Educational program for flood plain management; (7) Minor changes to well driller registration; and (8) A state-wide well driller licensing law. (R. H. Watson-Fla)

W69-00912

FOCUS ON THE HUDSON.

Department of the Interior, Washington, D. C., Bureau of Outdoor Recreation.

In Bureau of Outdoor Recreation, Government Printing Office, Washington, D. C., 1966, 50 p, 65 photo, 1 map, 6 ref.

Descriptors: *Water resource management, Recreation, Project planning, Federal project pol-

icy, Political aspects, *Outdoor recreation, National historic sites, Federal jurisdiction, Social needs, Jurisdiction, Scenic easements, Interagency cooperation, River basin development, Local governments, Highway beautification, Fish conservation.

Identifiers: Hudson River, Lower Hudson Waterfront, Hudson Highlands National Scenic Riverway.

The main emphasis of the report is on the development and maintenance of the recreational value of the Hudson. Basic issues of water pollution, inadequate public access to the river, uncoordinated approaches to planning, and conflicting land usage are discussed in light of their effects on the recreational environment. It is recommended that the States of New York and New Jersey amend legislation, to permit State Zoning review and control over local municipalities along the river, and amend taxing policies to encourage use of conservation easements and land use tools for preservation of historic sites. A land acquisition program is proposed to develop and revitalize the waterfront, which has fallen into disuse in many areas. Possible programs for the protection and development of fish and wildlife are presented. Industrial, commercial, residential, and institutional land uses should be fitted into an overall plan for preserving and protecting the scenic and recreational values of the Hudson. To this end a Federal-Interstate Compact is recommended. The scope of its responsibilities, jurisdiction, and authority is defined. (Gargola-Chicago)

W69-00949

WATER RESOURCES MANAGEMENT IN MARYLAND.

Maryland Department of Water Resources, Annapolis.

The Water Resources Study Committee, University of Maryland, 1967, 87 p, 6 photo, 3 tab, 1 fig, 75 ref.

Descriptors: *Water policy, *Water resources management, *State governments, Water supply, Water rights, Water law, Appropriation, Project planning, Regional analysis, Future planning, Coordination, *Adoption of practices, Decision making, Administrative agencies, Flood plain zoning, Long-term planning, Water resources development. Identifiers: Maryland.

Initially given is a brief summary of nineteen recommendations for overall water resources development in Maryland. Particular opportunities and problems are discussed. Water rights and regulations are reviewed and limitations of existing laws are pointed out. What is needed to facilitate solution of these problems and inadequacies is an overall water resources program for the entire state. For the development of an overall program the relationship between available resources and projected alternative uses must be defined. To this end, eleven suggestions are made to define the responsibilities of the Department of Water Resources: (1) overall planning, (2) data collection, (3) water quality surveillance, (4) sedimentation control, (5) information and education, (6) appropriation of dam and reservoir permits, (7) revision and review of laws, (8) efficiency of sanitary service in metropolitan areas, (9) participation in interstate water resources development, (10) state coordination of federal assistance, and (11) research in water development problems. (Gargola-Chicago)

W69-00955

ORGANIZATION FOR COMPREHENSIVE RIVER BASIN PLANNING: THE TEXAS AND SOUTHEAST EXPERIENCES, Michigan Univ., Institute of Public Administration. Robert H. Pealy.

University of Michigan, Ann Arbor, 1964, 164 p, 12 tab, 36 ref.

Descriptors: Project planning, *Adoption of practices, Evaluation, *River basin planning, *Decision making, Political aspects, Institutional constraints, Municipal water, Non-structural alternatives, Coordination, Administrative agencies, Water management, Adoption of practices, Multiple purpose projects, Project planning, Attitudes, River basin commissions.

Identifiers: U. S. Study Commission (Texas), U. S. Study Commission (Southeast River Basins).

Through a study of two experiences in comprehensive river basin development, it is hoped that new insights can be gained concerning the nature of planning and the organizations which do it. Assessments of both the Texas and Southeast River Basin Planning Commission is done through investigation of the constraints and influences which limited or prescribed their activities. Past traditions of planning and the legal framework in both instances are reviewed. The background and attitudes of Chairmen, Commissioners, and staff members who were responsible for major decisions was studied. Specialties of the staff and the number of workers through time is studied in relation to effects on the decision-making process. Comparison is made between the two agencies, and it is shown what major decisions affected the final plans, the process by which they were made, and why. For each commission the physical, economic, and political background is studied. The policy procedures and organization for operations is analyzed. In conclusion, the Texas Commission emerges as more an agency coordinating device while the Southeast Commission performs the more intended function of a planning organization. (Gargola-Chicago)

W69-00965

RIVERS AND REGIONALISM IN NEW ENGLAND,

Massachusetts Univ, Amherst, Bureau of Government Research.

Edwin Andrus Gere.

Booklet, University of Massachusetts, 1968, 71 p, 1 map, 87 ref.

Descriptors: Water resource development, Federal project policy, Project purposes, Project planning, *Federal jurisdiction, State jurisdiction, Federal government, Political aspects, Local governments, River basin planning, State governments, *Administrative agencies, Decision making, *River basin commissions, Interagency cooperation, Institutional constraints.

Identifiers: New England Interstate Water Pollution Control Compact, New England-New York Interagency Committee, Northeastern Resources Committee, New England Regional Planning Commission, New England.

Contrary to the allegation that the federal government is crushing state powers, this study theorizes that the federal government is actually strengthening state governments by openly encouraging the process of regional interstate cooperation. To test this theory, the study proceeded with a historical and developmental examination of federal activity in flood control, water pollution control, and water resource management. The nature of federal participation in regional cooperation for solution of these problems is shown to be strong, persistent and many-faceted. Basic formal mechanisms discussed are interstate compacts and direct congressional statutes, from which additional mechanisms are generated. The most appropriate description of an emerging federal role in regional planning, is that it is facilitating and enhancing state cooperation. These conclusions are derived from a study only of the New England region, and are limited to a federal activity for the region. (Gargola-Chicago)

W69-00966

WATER POLLUTION CONTROL IN WASHINGTON, Washington Univ., Seattle, Ctr. for Urban and Regional Research. L. A. Powe.

Nonstructural Alternatives—Group 6F

Reprinted separately as Univ. of Washington Reprint 13. Washington Law Review, Vol. 43, 1967, p 425-454, 1 append, 190 ref.

Descriptors: Water Pollution Control Act, Legal aspect, Pollution abatement, State governments, Federal governments, Jurisdiction, Water law, *Water pollution sources, Water pollution control, Water permits, *Paper pulp wastes, Pulp and paper industry, Regulation, Political constraints.

Identifiers: Puget Sound (Washington).

Reported are the Washington Pollution Control Commission's attempts to secure improved water quality in the Puget Sound area. Since the pulp industry is the major polluter of the region, the emphasis of the report is on attempts to control this industry. A history of the Commission's past efforts to control pollution through legal methods is reviewed. The permit system, enacted in 1955, is discussed in relation to the legal difficulties it encountered from the pulp companies. It was contended that the attempts to control their waste discharges represented a violation of their rights. Cases which relate to the validity of the Water Pollution Control Act, and its constitutionality are reviewed. Although it seemed by precedent that these allegations were unfounded, legal problems developed. Because of the difficulties encountered there has been little enforcement action since 1962. Certain legal developments in Federal and State law have strengthened the Water Pollution Control Act, which gives promise to the future. (Gargola-Chicago) W69-00967

SUMMARY REPORT ON TITLE TO BEDS AND USE OF NAVIGABLE STREAMS AND LAKES IN IDAHO

Idaho Univ., Moscow, College of Law.

Thomas R. Walenta.

Water Resour Res Inst Rep, Dec 1966. 35 p. OWRR Project A-010-Ida.

Descriptors: *Water policy, Navigable rivers, Water zoning, *Water law, Water levels, Lakes, *High-water mark, *Riparian rights, Lake beds, Lake shores, Streambeds, Legislation.

Federal and State laws and statutes governing the ownership and control in Idaho of the beds of navigable streams were studied together with their waters. State title to beds was rejected in 1908 by the Idaho Supreme Court in Johnson vs. Johnson; 14 Idaho 561; then in 1915 this was reversed by another court action. Navigability of streams and lakes was studied and laws explained as pertaining to use of the beds of those streams and lakes. Indian treaties and rights were also studied as related to ownership of the beds of streams. Proposed legislative changes and recommendations were pointed out. A discussion is also presented on the legislative role in the development of water resources of Idaho. (Warnick-Idaho Univ.) W69-00995

THE MUNICIPALITY AS A WATER-POLICY DETERMINING ENTITY

Cornell Univ., Los Angeles, Pol Sc Dept.

Winston W. Crouch.

Water Resour Center, Tech Completion Rep, Jan 1968. 4 p. OWRR Project A-014-Cal.

Descriptors: Water rights, *Municipal water, Water delivery, Water management, Water resources, Water sources, *Policy matters, Ground water, *Water policy, Water management (Applied), Water districts, Water development.

The objective was to examine the role of municipalities as water-policy determining entities in 4 southern California counties having a metropolitan-wide district organized to import water, supplementing local sources. Seven cities were studied with differing history in water development and service. Metropolitan-wide districts decided to not admit individual cities but

rather large blocks of land which included groups of cities and unincorporated territory. The question was the effect of this decision on the municipalities role as water distributors. Of cities organized before the 1930 decision, 80% have municipal water systems; only 18% incorporated after 1930 have municipal systems. The balance are served by private water enterprises, county water districts and other types of suppliers. The second question concerned whether the policies of those cities with municipal systems were developed as political or administrative processes. Very striking differences were found between cities, depending upon background policy and character of policy. W69-01003

STRATEGY AND ORGANIZATION IN PUBLIC LAND POLICY

RAND Corp., Santa Monica, Calif.

George R. Hall.

Natural Resources Journal, Vol 7, No 2, pp 162-182, April 1967.

Descriptors: *Public lands, *Natural resources, *Federal Project policy, *Land management, Administration, Constraints, Geographical regions.

Identifiers: Public Land Law Review Commission, *Externalities, Exclusionary uses, Heterogeneity of land holdings, *Goods.

Significant managerial and policy improvements in the natural resources sector will require a significant reorganization of federal departments and agencies. This paper considers the strategic objectives of public land and management and the factors that make achieving these objectives a complex and difficult task. Four complicating factors are examined: externalities, exclusionary land use, heterogeneity of public land holdings and divided governmental responsibility. The last is identified as the most important barrier in the way of achieving major improvements in public policy towards natural resources. Two reforms are needed. The first is an end-use approach to policy formulation. The second and related reform is a reorganization of the administration of the federal government's natural resource responsibilities. (Seneca-Rutgers) W69-01101

DIGEST OF WATER POLLUTION CONTROL LEGISLATION, DELAWARE

Fed Water Pollut Contr Admin, July 1966. 4 p.

Descriptors: *Delaware, *Water pollution control, *Legislation, Water law, Delaware River Basin Commission.

This digest contains a brief outline of the laws and the organization and duties of the State agency empowered to carry out the anti-pollution water laws. Where State law provides for stream classification this has been set out together with a list of waterways or waters which have been classified by the particular legislature, the year it was done, and the classification. W69-01121

WATER AND RELATED LAND RESOURCES LAW AND POLITICAL INSTITUTIONS

Cornell Univ., Ithaca, N.Y.

William H. Farnham.

Tech Rep 8, Water Resour Center, Nov 1967. 55 p, 95 ref. OWRR Project A-003-NY.

Descriptors: Boundaries (Property), *Riparian rights, Properties, Legal aspects, Administration, *Water law, *Water rights, *New York, Legislation, Administrative decisions, State government.

One function of social science research is to provide an understanding of social processes and justifications to allow their modification, improvement, and adjustment to new conditions. This project is one more step in modernizing the water law of the east, particularly New York state's version of

Riparian Doctrine. Each step is conditioned by an overall strategy to remove uncertainty in the law without undue loss of flexibility. Further, strategy rejects as either feasible, desirable, or politically possible any major shift in water law doctrine. Instead it accepts the notion that through a review of carefully studied, well understood steps, a sounder foundation for the future can be built. Two significant changes in statute law have been proposed. The first clarified the law with respect to the legality of alterations in the natural condition of water courses and lakes which cause no harm to others, declaring them lawful and avoiding the necessity for suit by others to protect their rights until actually harmed. The second suggests that harmful alterations be lawful if reasonable and provides some guidelines for reasonableness. These changes, when adopted, will provide a clear base from which further changes can be made. W69-01135

FIRST ANNUAL SOUTH CAROLINA GOVERNOR'S CONFERENCE ON WATER RESOURCES

Clemson Univ., South Carolina.

Water Resour Res Inst, Mar 1967. 85 p, 1 tab. OWRR Project A-999-SC.

Descriptors: *Water resources, *Water resources development, Water quality, Water pollution, Waste treatment, Water law, Planning, Water management (Applied), Water Resources Research Act, *South Carolina, Responsibilities, Water pollution control, Hydroelectric power, Long-term planning, Conferences, Water utilization.

Identifiers: Water plans, Water use.

The First Annual South Carolina Governor's Conference on Water Resources held March 1 and 2, 1967, at Columbia, South Carolina, was for the primary purpose of: (1) exploring the current water situation in South Carolina and its relation to the national picture; (2) establishing the State's responsibilities in all aspects of Federal-State cooperation in water resources; and (3) considering programs in water resources planning and development for South Carolina. Ten papers relative to these 3 categories were presented and are published in the Conference proceedings. W69-01142

6F. Nonstructural Alternatives

FLOOD CONTROL VIA THE POLICE POWER

Allison Dunham.

U Pa L Rev, Vol 107, No 8, pp 1098-1132, June 1959. 35 p, 128 ref.

Descriptors: *Flood plain zoning, Regulation, *Flood protection, Flood control, State governments, Flood plain insurance, Land use, *Flood damage, Federal government, Federal-state water rights conflicts, Legislation, Legal aspects, Project purposes, Dams, Building codes, Economic justification, Risks, Government finance.

Despite extensive study and agitation concerning water resources, public expenditure on water problems, and federal-state relations involving water, very little change in policy has occurred in the past ten years. It is the purpose of this paper to examine briefly the history of the movement toward regulation of land use in the flood plain; to suggest a conceptual framework by which the consequences of such regulation may be judged; to analyze the reasons advanced for this restriction on individual decisions concerning use of private land; and finally, to consider the constitutional basis of this proposed use of the state's police powers. Throughout this paper the term flood plain zoning is used to cover all of the types of regulation which can be used to regulate land use for the purpose of affecting flood losses. (R. Smith-Fla) W69-00756

Field 06—WATER RESOURCES PLANNING

Group 6F—Nonstructural Alternatives

A STUDY TO DETERMINE THE STATE AND COMMUNITY RESPONSIBILITIES INHERENT IN FLOOD DAMAGE PREVENTION PLANNING IN URBAN DEVELOPMENT,

Maybelle C. Fox.

Unpublished Master's Thesis, Univ. of Miss., Department of Urban and Regional Planning, University, June 1969, 87 p, 1 append, 53 ref.

Descriptors: Urbanization, Community development, *Flood control, Multiple-purpose projects, *Non-structural alternatives, Land-use, *Flood plain zoning, Psychological aspects, Government supports, Inter-agency cooperation, Dams, Reservoirs, Channel improvements, Flood forecasting, Research and development.

Identifiers: Flood plain management, Citizen participation, University of Mississippi, Public education.

The purpose of this thesis is to determine the State and community responsibilities inherent in a successful flood damage prevention planning program. The need for flood control by preventive planning in addition to corrective measures was determined as a result of investigations conducted during the study. The major types and methods of flood control were identified, together with an analysis of their use. On the basis of the identification of these methods, the various levels of government can develop a suitable program of flood damage prevention. The importance of intergovernmental coordination and responsibility in plan formulation and implementation was stressed. Cited are examples of laws, ordinances, and regulations that have been used in flood plain management. Recommendations made are: (1) studies to determine the potential flood hazard; (2) structural methods of flood control alone are not adequate protection from flooding; (3) local citizen acceptance and participation in the program; (4) analysis of corrective and preventive measures for each locality; and, (5) where necessary, the local government should seek assistance from the State and Federal governments. (Gargola-Chicago)

W69-00946

AN ECONOMIC APPROACH TO COPING WITH FLOOD DAMAGE,

Resource for the Future, Inc., Washington, D.C.

John V. Krutilla.

Water Resources Research, Vol 2, No 2, pp 183-190, Second Quarter 1966. 2 ref.

Descriptors: *Flood damage, *Flood plain insurance, *Flood protection, Insurance, Efficiencies, Flood plains, Flood control, Cost sharing, Benefits, Costs.

Identifiers: *Insurance premiums, Public good, Residual damage potential, Compulsory flood insurance, Social cost, Private cost.

A compulsory flood loss insurance scheme is one means of achieving efficient uses of flood plain lands. Insurance premiums proportional to risk and equal to both the private and the social cost of flood plain occupancy will serve as a rationing device, eliminating economically unwarranted uses of flood plain lands on the one hand, while not prohibiting uses for which a flood plain location has merit. In addition, reduction of flood loss insurance premiums can serve as a standard to measure economic justification of alternative flood control measures and/or discrete increments in the scale of protective works or other nonstructural flood control measures. A final advantage of flood loss insurance, which no alternative of flood management possesses, is indemnification for the residual damage potential against which it is not economic to seek protection. (Seneca-Rutgers)

W69-01090

6G. Ecologic Impact of Water Development

AN INVENTORY AND STUDY OF BEAVER IMPounded WATER IN MISSISSIPPI,

Mississippi State Univ., State College.

Dale H. Arner, James Baker, and David Wesley. Water Resour Res Inst Rep, July 1966. 26 p, 8 fig, 10 tab, 6 ref. OWRR Project A-009-Miss.

Descriptors: *Beavers, *Pond, *Waterfowl, Aquatic life, Ducks (Wild), Weed control, Invertebrates, Wildlife, Wildlife management, Conservation, *Impoundments, Mississippi.

A cooperative program was inaugurated with Federal and state conservation agencies to inventory beaver ponds and acreage contained in these impoundments in the state of Mississippi. Cooperating agencies reports revealed a total of 956 beaver ponds of 1 acre and over and a total of 23,673 acres flooded by beaver ponds. Research workers checked 10% of the ponds to determine accuracy of acreage estimates made by cooperating agencies and to determine acreage suitable for developing into waterfowl feeding areas. This revealed a statistically significant correlation between estimates made by cooperating agencies and measurements made by investigators. In the beaver ponds studies, 58.1% contained areas which could be planted to duck millet. It was estimated that with emergent weed control 56.5% of the total acreage of these ponds could be developed into duck feeding areas. In the Loess area invertebrates taken by all 3 techniques were in significantly greater abundance in beaver ponds than in upstream sites. In Upper Coastal Plains soils area, the weight or volume of captured invertebrates was greater in beaver ponds than in upstream sites, but was significantly greater only using the net sweeping technique.

W69-00730

CITY OF ATLANTA V WILLIAMS (SURFACE DRAINAGE).

218 Ga 379; 128 S E 2d 41-43 (1962).

Descriptors: *Drainage, *Ditches, Surface waters, Easements, *Overflow, Riparian rights, Drainage water, Water law, Legal aspects.

The plaintiff sought to enjoin the city from using its drainage ditch near his property in such a manner that surface waters overflowed onto his property. The court held that the city had, by a use of the ditch for 20 years, acquired an easement by prescription but there had been no continuous overflow of water from the ditch and the city did not have an easement to overflow the ditch. The city was under a duty to maintain the ditch so that the content and flow of surface waters would not overflow. (Horner-Fla)

W69-00825

07. RESOURCES DATA

7A. Network Design

THE MOVEMENT OF RADIONUCLIDES THROUGH SOIL FORMATIONS,

Iowa State Univ., Ames.

For primary bibliographic entry see Field 05B.

For abstract, see .

W69-00708

OPTIMUM DENSITY OF RAINFALL NETWORKS,

Massachusetts Institute of Technology, Cambridge. Dept of Civil Engineering.

P. S. Eagleson.

Water Resources Res, Vol 3, No 4, pp 1021-1033, 1967. 13 p, 10 fig, 12 ref.

Descriptors: *Statistical methods, *Network design, *Climatic data, *Rainfall, Rainfall disposition, Fourier analysis, Linear programming, Hydrography, Distribution patterns.

Identifiers: Network density.

Techniques of harmonic analysis and the concepts of distributed linear systems are used to study the sensitivity of peak catchment discharge to the

characteristic spatial variability of convective and cyclonic storm rainfall. Application of the sampling theorem leads to quantitative general relations for optimum rainfall network density for the study of long-term, catchment-average rainfall is accomplished by considering the long-term point rainfall as a homogeneous random variable to be sampled spatially. Incorporation of catchment dynamics into the design of flood forecasting networks reduces the number of gages needed when compared with that obtained solely through consideration of precipitation variability. In many studies little advantage is gained by utilizing more than 2 properly located stations for the determination of long-term areal mean rainfall. (Author) W69-01046

7B. Data Acquisition

ESTIMATION OF GROUND-WATER CONFIGURATION NEAR PAHALA, HAWAII USING ELECTRICAL RESISTIVITY TECHNIQUES,

Hawaii Univ., Honolulu.

For primary bibliographic entry see Field 02F.

For abstract, see .

W69-00710

EFFECTS OF INDUCED STREAMBED INFILTRATION ON WATER LEVELS IN WELLS DURING AQUIFER TESTS,

Minnesota Univ., Minneapolis.

For primary bibliographic entry see Field 02F.

For abstract, see .

W69-00723

INFLUENCE OF TURBULENCE ON SURFACE REAERATION,

Illinois Univ., Urbana.

For primary bibliographic entry see Field 05F.

For abstract, see .

W69-00728

THE CONTINUOUS PLANKTON RECORDER—A REVIEW OF THE LITERATURE,

Minnesota Univ., Minneapolis.

Theodore A. Olson, Theron O. Odlaug, and

Wayland R. Swain.

Water Resour Res Center Bull 3, June 1966. 221 p, 92 fig, 6 plate, 21 tab, 40 ref. OWRR Project A-011-Minn.

Descriptors: Deep water, Limnology, Atlantic Ocean, Eddies, Ocean currents, Indicators, Organic matter, Aquatic environment, Zooplankton, Aquatic life, Aquatic populations, Biology, Eutrophication, Lakes, *Productivity, Trophic level, *Plankton, *Research equipment, Biomass, Phytoplankton.

The literature concerning the Continuous Plankton Recorder (CPR) is reviewed in this report. The Hardy Recorder can be towed behind a commercial vessel proceeding at normal speed. Organisms of the plankton assemblage are swept into the mouth of the sampler and then are carried back to a point where a slowly moving bolting cloth band crosses the water tunnel. The band, which forms a complete barrier at this point and is supported at the back by a coarse grid, strains out the organisms. Later, in the laboratory, the bands can be unrolled on a special stage and examined under a microscope. Since the towing path and speed are known and the rate of tape advance within the sampler is also known, specific portions of the bolting cloth surface can be associated with definite lake areas and a mile-by-mile estimation of the net-plankton distribution is possible. The use of the recorder has been limited almost entirely to the marine environment but the same technique should be readily applicable to studies of the organisms comprising the second trophic level in fresh water. W69-00740

A PROPOSAL TO STUDY HYDROLOGICAL DATA ACQUISITION THROUGH REMOTE RECONNAISSANCE SYSTEMS,
Montana Univ., Missoula.
Fred L. Gerlach.
Water Resour Res Center Rept, 1966. 10 p, 7 fig, 2 ref. OWRR Project B-002-Mont.

Descriptors: *Hydrologic data, Data collections, Hydrology, Surfaces, Moisture content, *Remote sensing, *Infrared radiation, *Soil moisture, Thermal radiation, Aerial photography.
Identifiers: *Infrared imagery, Infrared scanning, Aerial reconnaissance.

Areas considered by the pilot study of 1965-66 were: (1) characteristic surface temperature and surface radiation differences of selected terrain features (those having surface moisture differences). (2) Characteristic tonal contrasts on aerial infrared scanned imagery with proper consideration for other identifying characteristics in the interpretation of this imagery produced by temperature and radiation differences between features. (3) Increased probability for correct interpretation by increasing differences registered in the imagery through selection of optimum conditions or time for collecting the imagery. It is apparent from data that the time of day relative to the amount of insolation receipt is highly important. Also, weather conditions existing prior to and during the data collection characteristics of surface moisture conditions. Other work included: (1) laboratory tests of surface temperature; (2) airborne radiometric surface temperature measurements; and (3) the establishment of a series of plots for airborne radiometric temperature measurement. The objectives of this study have been partially reached. Continued study is necessary to provide a base for a broader and more intensive application of remote reconnaissance methods to water resources management and research.
W69-00742

RESPONSE OF FLOAT TYPE STAGE RECORDER SYSTEMS,
Purdue University, Lafayette, Indiana.
J. W. Delleur, and D. Blank.
Purdue Univ Eng Reprints CE 241, pp 165-172, Feb 1968. 8 p, 5 fig, OWRR Project A-001-Ind.

Descriptors: *Instrumentation, *Research and development, *Water levels, *Floats, *Gages, Stream gages, Depth.
Identifiers: *Stage recorders.

To aid in evaluating performance of hydrologic systems by measuring water yield, the frequency response and phase distortion of the measuring equipment were studied. A float type stage recorder was installed above an oscillating tank used for generating the water level fluctuations. The tank can be subjected to a vertical harmonic motion with amplitudes ranging from 4 to 10 in. and frequencies 2 to 15 cycles per minute. The dynamic equations of motion of the float are developed with and without taking into account the influence of the friction forces. The motion of the water surface as recorded by a sonic transducer was compared with the motion of the float as obtained from the stage recorder. The results indicate that the float follows the motion of the surface of the water very closely, and that, within the amplitude and frequency range tested, there is no significant signal deformation. (Knapp-USGS)
W69-00919

EVALUATION OF THE GAMMA TRANSMISSION METHOD FOR DETERMINING SOIL WATER BALANCE AND EVAPOTRANSPIRATION,
Clemson University, Clemson, S C. Agricultural Engineering Department.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-00936

ATOMIC FLUORESCENCE FLAME SPECTROMETRY,
New Hampshire University, Durham.
David W. Ellis, and Donald R. Demers.
Advances in Chem Ser, No 73, pp 326-336, 1968. 11 p, 4 fig, 3 tab, 22 ref. OWRR Project A-003-NH.

Descriptors: *Chemical analysis, *Flame photometry, *Fluorometry, Inorganic compounds, Instrumentation, Water analysis.
Identifiers: Atomic fluorescence flame spectrometry.

The use of atomic fluorescence flame spectrometry in the analysis of trace inorganics is reviewed and evaluated. The method is competitive with and often superior to atomic absorption and flame emission methods. Its advantages are that intensity of response may be controlled, light source emission profile may be wider than the absorption profile of the sample, the response signal is added to background and may be electronically amplified, and calibration curves are linear over a wide sample concentration range. With a line source, the method is more sensitive than other flame methods. With a continuous source, both qualitative and quantitative analyses may be made simultaneously. (Knapp-USGS)
W69-00940

INSTRUMENTATION FOR SEISMIC EXPLORATION FOR GROUND WATER IN HAWAII,

Hawaii Univ., Honolulu.
Leonard A. Palmer.
Tech Rep 7, Water Resour Res Center, Apr 1967. 26 p, 12 fig, 5 ref. OWRR Project A-009-Hi.

Descriptors: *Instrumentation, *Groundwater, *Exploration, Seismic studies, Seismology, Explosions, *Hawaii, Water table.

This study developed instrumentation and techniques to be used for seismic exploration of ground water in Hawaii. A 3-stage field test of instruments and methods was conducted to determine capability of recording and reproducing seismic data. Reproducibility was the main criterion to permit using certain signal analysis techniques. Multi-channel explosive tests utilizing dynamite shots were carried out in Waimanalo, Oahu during first stage of testing. The second stage used a 2-channel magnetic tape recorder converted to receive voice and uphold geophone signals on 1 channel and seismic signals on the other channel. Stage 3 tested the use of a 'thumper' acoustical source, seismic filters, and timers developed for the project. Signals generated by explosives and recorded photographically were very reproducible, but this is relatively expensive and analysis is slow. Seismic data recorded on magnetic tape allows versatility in analysis of recorded signals reproduced either in wiggle or intensity contrast analog form. Sections can be selected for digital computer analysis. The findings from this pilot phase do not indicate that seismology would not be an appropriate tool for studying geological structure.
W69-00974

PILOT EVAPOTRANSPIRATION STUDY: LYSIMETER DESIGN,
Hawaii Univ., Manoa.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-00981

REMOTE SENSING OF HAWAIIAN COASTAL SPRINGS USING MULTISPECTRAL AND INFRARED TECHNIQUES,

Hawaii Univ., Manoa.
Larry K. Lepley, and Leonard A. Palmer.
Tech Rep 18, Water Resour Res Center, Aug 1967. 39 p, 16 fig, 3 tab, 31 ref. OWRR Project B-005-Hi.

Descriptors: *Remote sensing, Water resources, Aerial photography, Temperature, Thermometers, *Springs, Synoptic analysis, Photography, Spec-

tophotometry, Color, Hydrology, Sea water, Fresh water, Coasts.
Identifiers: Radiometers, Infrared imagery, Infrared spectroscopy.

Two remote sensing techniques for measuring offshore ground-water spring discharge have been studied: (1) multispectral photography, and (2) infrared thermometry. During the summer of 1967, exposure factors for filter-film-camera combinations extending outside the visible spectra were experimentally determined and tabulated. One spectral series of simulated aerial photography was obtained. Darkroom procedures and equipment for multispectral enhancement of the suspected color differences between sea water and offshore spring water in these photographs have not yet been precisely defined. Helicopter flights with an infrared thermometer have demonstrated that offshore springs can be identified by their temperatures. Due to the irregular shape, size, and location of these fresh water outflows, a synoptic technique is needed. An infrared scanner is desirable but the present costs are prohibitive.
W69-00982

SOME SEISMIC TECHNIQUES FOR MAPPING SMALL SCALE SHALLOW STRUCTURES,
Hawaii Univ., Manoa.
Cornelius Joziasse, and William M. Adams.
Tech Rep 11, Water Resour Res Center, Aug 1967. 15 p, 10 fig, 4 ref. OWRR Project B-005-Hi.

Descriptors: Hawaii, Microwaves, Seismic waves, Seismic studies, Vibrations, Mapping, Geologic mapping, Surveys, Geophysics, *Seismic investigations, *Seismographs, Subsurface investigations, Exploration, Instrumentation.

Identifiers: Reflectivity, Seismic tests, Oahu, Hawaii, Seismic refraction, Seismic reflection.

Seismic recording and playback techniques and equipment are being developed for use in mapping small-scale geologic structures of significance in controlling movement of ground water. High-frequency seismic waves produced by weight-dropping, or thumping, are used to provide the necessary resolution to detect these small structures. A vibrator has been constructed as another source of high frequency seismic energy. A DC motor is the transducer with storage batteries providing the power. A 4-channel tape recorder is used to obtain seismic records on a 10-ft spacing. This spacing gives good correlation from record to record. A storage oscilloscope gives visual displays of seismic data as wiggly line playbacks which are stored on the screen and then photographed. Also being used is variable intensity playback of reflection records. This allows signal averaging to be done optically and gives an easily interpreted display. A seismic survey done in the Waimanalo area on Oahu, Hawaii indicates that the thumper can produce sufficient amounts of high frequency energy to permit shallow reflection prospecting.
W69-00985

SEDIMENT SAMPLING: INSTRUMENTATION AND TECHNIQUES,
Dept. of Agriculture, Oxford, Miss., Sedimentation Laboratory.
C. R. Miller, and A. J. Bowie.
Trans Amer Soc Agr Eng, Vol 8, No 2, pp 267-270, 274, 1965.

Descriptors: *Bed load, Sediment load, *Sediment transport, *Sediment discharge, *Sampling, *Instrumentation, Arid lands, Data collections, Measurement, Streams, Technology, Research and development, Mechanical equipment.

The various instruments and techniques currently employed by the U.S.D.A. Sedimentation Laboratory to sample sediment discharge were described. Major problems associated with accurate determination of total sediment movement and measurement of sediment discharge on rapid rising streams and at remote locations were discussed. A variety

Field 07—RESOURCES DATA

Group 7B—Data Acquisition

of methods to improve and automate sediment sampling that are under investigation by the Federal Inter-Agency Sedimentation Project were described. Continuing research will provide guides and methods for combining field sediment-sampling results with stream hydraulics and sediment characteristics in the development of methodology for determining total sediment discharge that occurs in streams that are located in the arid parts of the world. (Blecker-Ariz)
W69-01015

A TECHNIQUE TO DETERMINE EVAPORATION FROM DRY STREAM BEDS,
Ariz. Univ., Tucson. Institute of Atmospheric Physics.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-01026

RADAR ESTIMATION OF RAINFALL,
New Zealand Meteorological Service, Wellington.
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-01029

ON THE COMPARISON OF PRECIPITATION GAUGES,
India Meteorological Office, Poona.
V. Kalyanasundaram.
Indian J Meteorol Geophys, Vol 17, No 4, pp 627-632, October 1966. 6 p, 3 fig, 3 tab.

Descriptors: *Precipitation gages, *Arid climates, Measurement, *Reliability, *Rain gages, Instrumentation, Data collections, Variability.
Identifiers: *Comparisons, India.

Reliability of rainfall measurements made in India were assessed using comparisons between rain-gauges in routine use in the national network and raingauges adopted by W.M.O. as International Reference Precipitation Gauges (IRPG). Differences between the 24-hour rainfalls recorded by two I.M.D. gauges varied between 0.4 and 1% while differences between two IRPG's were smaller and insignificant. All differences were insignificant above a daily rainfall of 25mm. Descriptions of the various raingauges and details of their installation were given. In order to determine and compare hydrologic factors that occur on different arid watersheds of the world, raingauges used in these areas must be correlated in order to receive valid information from these different localities. (Blecker-Ariz)
W69-01030

IMPROVEMENT AND TEST OF AN INSTRUMENT FOR RECORDING COARSE SEDIMENTS,
N. Ya. Solov'yev.
Soviet Hydrol: Selec Pap, No 2, pp 158-172, 1967. 15 p, 9 fig, 2 tab, 6 ref. Translation from Trudy GGI, No 141, pp 58-78, 1967.

Descriptors: *Instrumentation, *Sediment discharge, *Salts, Streams, Flumes.
Identifiers: USSR, Coarse sediment sensor.

An instrument for detecting coarse sediment particles moving above stream beds is described. The principle of operation is the impact of particles on a plate connected to the moving part of an induction transducer. The signal produced is proportional to the product of mass and velocity of the particle. Because the instrument changes the pattern of flow locally so that particle velocity on impact with the receiving plate is not the same as in the undisturbed stream, calibration experiments were made in a flume in a mountain stream. Data from the sensor are recorded by a five channel pulse height analyzer. Field tests show that the response of the sensor to fluctuating sediment discharge is more accurate than the results of standard determinations by sampling. (Knapp-USGS)
W69-01041

A SENSOR FOR WATER FLUX IN SOIL. 'POINT SOURCE' INSTRUMENT,
Commonwealth Scientific and Industrial Research Organization. Div. of Land Research, Canberra (Australia).
G. F. Byrne, J. E. Drummond, and C. W. Rose.
Water Resources Res, Vol 3, No 4, pp 1073-1078, 1967. 6 p, 2 fig, 10 ref.

Descriptors: *Groundwater movement, *Instrumentation, *On-site tests, *Current meters, *Flowmeters, Calibrations, Research and development.
Identifiers: Soil water flux meters.

The theoretical analysis and laboratory calibration of a sensor to measure fluid in soil or other porous medium shows that a flow velocity of .0001 cm per sec can be readily measured, and that output is uniquely related to flux. The flow to be measured causes asymmetry in the temperature field generated by an approximation to a point source of heat located centrally in the instrument. The temperature difference due to this asymmetry gives rise to the output of the instrument. The instrument was tested and calibrated in a saturated clay loam. The sensitivity is such that there is some promise that the instrument may be of utility in flux measurement in unsaturated as well as saturated media. (Author)
W69-01050

A STUDY OF GROUND-WATER CONTAMINATION DUE TO OIL-FIELD BRINES IN MORROW AND DELAWARE COUNTIES, OHIO, WITH EMPHASIS ON DETECTION UTILIZING ELECTRICAL RESISTIVITY TECHNIQUES,
Ohio State Univ., Columbus.

For primary bibliographic entry see Field 05B.
For abstract, see .
W69-01119

7C. Evaluation, Processing AND Publication

WATER RESOURCE OBSERVATORY CLIMATOLOGICAL DATA WATER YEAR 1966 AND PRIOR.
Wyoming Univ., Laramie.

For primary bibliographic entry see Field 02B.
For abstract, see .
W69-00978

AUTOMATIC PROCESSING OF OPERATIONAL HYDROLOGIC INFORMATION,
Hydrometeorological Sciences Research Center, USSR.

Ye. P. Cherenko.
Soviet Hydrol: Selec Pap, No 2, pp 189-194, 1967. 6 p, 1 fig. Translation from Trudy GMTs No 2, pp 59-66, 1967.

Descriptors: *Data processing, *Computers, Data transmission, Networks, Telemetry, Statistical methods, Numerical analysis.
Identifiers: USSR, Hydrological data network, Automatic data handling.

Some problems associated with automation of the processing of hydrologic information received at the USSR Hydrometeorological Scientific Research Center are examined. Variants of programs for recoding, storing, and searching and preparing the needed parameters for computation are described. At present practically all hydrologic information is processed by hand. Numerical methods of forecasting are nearly never used in operational work. Most of the forecasting methods are based on the use of relatively simple empirical relationships which have insufficient reliability and accuracy, so an important role is played by the experience and intuition of the forecaster. Furthermore, at present the data input is too small for automatic processing of hydrologic data alone to be economically feasible. However, meteorological data are handled automatically and are the major part of the work at the hydrometeorological center. (Author)
W69-01044

Hydrological data can be included at very little additional cost when appropriate methods of analysis are developed. Current studies in the use of computers in handling hydrologic data include multidimensional statistical analysis and numerical methods for solving differential equations. (Knapp-USGS)
W69-01032

SOLUTION OF INVERSE PROBLEMS FOR LINEAR FLOW MODELS,
Hydrometeorological Sciences Research Center, USSR.

L. S. Kuchment.
Soviet Hydrol: Selec Pap, No 2 pp 194-199, 1967. 6 p, 3 fig, 10 ref. Translation from Meteorologiya i gidrologiya, No 4, pp 73-79, 1967.

Descriptors: *Linear programming, *Mathematical models, *Hydrographs, *Routing, Inflow, Discharge (Water), Computers, Optimization.
Identifiers: USSR.

A linear mathematical model for computing flow hydrographs is discussed. It is also possible to use the model inversely to find input using the outflow hydrograph and the given functional relation, and the functional relation may be found given inflow and outflow. Instabilities in the solutions are avoided by use of the theory of incorrect problems, based on a method of best approximation. (Knapp-USGS)
W69-01034

A METHOD OF DETERMINING THE PERMEABILITY AND EFFECTIVE POROSITY OF UNCONFINED ANISOTROPIC AQUIFERS,
Technion Israel Institute of Technology, Haifa.

G. Dagan.
Water Resources Res, Vol 3, No 4, pp 1059-1071, 1967. 13 p, 8 fig, 1 tab, 16 ref.

Descriptors: *Groundwater movement, *Drawdown, *Unsteady flow, *Aquifer characteristics, *Anisotropy, Thesis equation, Permeability, Porosity, Transmissivity.
Identifiers: Anisotropic aquifers.

The equations of unsteady flow toward a partially penetrating well in an unconfined aquifer of finite thickness are solved by linearization. It is assumed that the aquifer is nondeformable and the effective porosity at the water table is constant. It is also assumed that the aquifer is anisotropic (the principal axes of the permeability tensor being horizontal and vertical, respectively), that the pumping discharge is constant, and that the drawdowns are small. The vertical component of the flow velocity is not neglected. The solution is therefore, equally valid in the vicinity and at large distances from the pumping well. In the latter case, it coincides with the Thesis solution. A method of matching the theoretical solution with drawdown measurements during pumping tests is outlined. By the matching method the horizontal and vertical hydraulic conductivities and the effective porosity of the aquifer may be determined. The method is illustrated by analyzing data from pumping tests carried out in three anisotropic aquifers. (Author)
W69-01044

ANALYSIS OF NON LINEARITIES IN GROUND WATER HYDROLOGY: A HYBRID COMPUTER APPROACH,
California Univ., Los Angeles.

Venkateswarao Vermuri, and John A. Dracup.
Water Resources Res, Vol 3, No 4, pp 1047-1058, 1967. 12 p, 8 fig, 14 ref.

Descriptors: *Groundwater movement, *Equations, *Digital computers, *Analog computers, Model studies, Hydrology.
Identifiers: Navier-Stokes Equations, Hybrid computers.

A hybrid computer method to solve nonlinear partial differential equations describing the flow of fluids in underground formations is described. Using finite difference methods, the problems are first programmed by a flow chart for a pure digital computer solution. Because the ability of resistance networks to solve a set of simultaneous equations instantaneously is recognized, major matrix inversion subroutines in the digital flow chart are replaced by analog resistance network hardware. Incorporation of analog hardware drastically reduces the computation time involved in inversion of large matrices. The resistance network constructed on an analog computer patch board allows an unparalleled flexibility not available in a digital computer. (Author) W69-01047

SCHEMES FOR HANDLING INCONSISTENT MATRICES.

Harvard Univ, Cambridge, Massachusetts.

Myron B. Fiering.

Water Resources Research, Vol 4, No 2, pp 291-297, April 1968. 2 append.

Descriptors: *Statistical methods, Correlation analysis, Efficiencies, Monte Carlo method.

Identifiers: *Inconsistent matrices, *Multivariate analysis, Algorithms, Eigenvalue, Consistency, Linear transformation.

The increasing role of multivariate statistical techniques, a trend based on the growing availability of computers and on pressures for streamlined representation of multidimensional arrays of data, carries with it the responsibility for using efficient methods to manipulate matrices and arrays. It frequently happens that all records in a multivariate system (of flow records, quality measurements, or whatever) are not equally long, and that some subsets of these records do not present a consistent pattern of correlation when the entire bivariate correlation matrix is reconstructed. If one or more estimate is such that the entire correlation matrix is rendered inconsistent, repairs must be effected before continuing the multivariate analysis. Two algorithms for systematically finding a set of adjustments that satisfy the requirements of consistency are given, however, the results are not unique. (Seneca-Rutgers) W69-01063

STATUS EVALUATION OF SURFACE WATERS IN TEXAS.

Texas Agricultural and Mechanical Univ, College Station.

William J. Clark.

Rep, Biology Dept, 1966. 102 p, 6 tab, 296 ref, 2 append. OWRR Project A-005-Tex.

Descriptors: *Texas, Publications, *Bibliographies, *Personnel, Fish, Organizations, Limnology, Aquatic microbiology, Inland waterways, *Surface waters, Evaluation, Reviews.

Data have been gathered concerning publications, personnel, and government organizations related to the limnology, aquatic biology and ichthyology of the inland waters of Texas. A total of 289 citations of published papers, dissertations and thesis have been found and organized by a computer program into a Keyword in Context (KWIC) index and an alphabetical bibliography. Reports of the Texas Parks and Wildlife Department containing pertinent information are indexed in an alphabetical table by name of the body of water studied. A partial list of taxonomic papers from bordering states is included as an appendix. Addresses, names of pertinent officers and personnel, and a brief description of duties and jurisdictions, are listed for 17 state and federal agencies. Course titles and instructors names are listed for pertinent courses at 13 colleges and universities in the state. W69-01116

A STORAGE AND RETRIEVAL SYSTEM FOR THE NEVADA WATER RESOURCES DATA CENTER.

Nevada Univ, Reno.

L. Crouse, and G. B. Maxey.

Water Resour Res Center, Proj Rep 5, Desert Res Inst, Feb 1967. 13 p, 2 ref. OWRR Project A-010-Nev.

Descriptors: *Data storage and retrieval, Computer programs, Data processing, Data transmission, *Information retrieval, Data collections, Nevada, *Water resources, Water resources development.

The objective of the data center is to provide an information storage and retrieval system to facilitate water resource research. Because data is widely scattered in the files of different government and other agencies, items are not in standard format, and calculations often have to be made by hand, or, if a computer program is used, has to be coded by key punching, and the time and expense these problems incur, much water resource data which could be used is not. The data center alleviates these problems by providing uniform data formats, efficient storage, rapid retrieval and the integration of routine calculations into the main storage and retrieval program. The center collects and formats incoming water resource data then processes, stores and retrieves it on a computer system. It allows the researcher to have quick access to information in standard formats, with routine calculations automatically made for him, and enables him to easily and quickly call for sort and up-date operations. The progress of the Nevada Water Resources Data Center to date is included. (J. Phoenix-Nevada). W69-01118

STORAGE AND RETRIEVAL OF DATA FOR WATER QUALITY CONTROL.

Federal Water Pollution Control Administration, Washington, D.C.

Richard S. Green.

Fed Water Pollut Contr Admin, Aug 1966. 36 p, 13 fig, 4 tab, 2 ref, 3 append.

Descriptors: Water quality control, Information retrieval, *Data storage and retrieval, Data collections, Computer programs, Hydrologic data, *Water quality.

Identifiers: *Water quality data, *STORET.

This system for the storage and retrieval of data for water quality control was developed from ideas brought together in a brief informal conference held in the Basic Data Branch, Division of Water Supply and Pollution Control, U.S. Public Health Service, in August 1961. In this publication the following information is presented: (1) The current water quality control data handling situation, (2) Scope of the system, (3) The system design, (4) Storage procedure, (5) Deleting and changing data, (6) Use of data from other systems, (7) Retrieval routine. W69-01126

INVENTORY OF PRINTED INFORMATION AND DATA PERTAINING TO WATER AND RELATED RESOURCES OF NEVADA.

Nevada Univ, Reno.

Hugh A. Shamberger.

Center Water Resour Res, 1967. 144 p, 1300 ref.

Descriptors: *Water resources, Bibliographies, Publications, Water resources development, Information retrieval, *Nevada.

This publication attempts to inventory all of printed information pertaining to Nevada's water resources together with a fairly complete listing of related resources publications. This publication is divided into 2 basic indexes: an author index and a subject index. Reports prepared for an agency but listing individual authors have been listed under the authors index as well as the agency name. Papers prepared for agencies which do not identify the

author are indexed according to agency name. Listing of authors and subjects is alphabetical. When there are 2 or more coauthors, the first named is considered the senior author and the subject matter is listed under his name. The names of the coauthors are listed and referenced to the senior author. The subject index does not cover every paper in the author index but is sufficiently complete to meet most demands. W69-01128

PERMUTED TITLE INDEX--1963.

Cornell Univ, Ithaca, N.Y.

Water Resour Center, 1963. 90 p, 1298 ref. OWRR Project A-999-NY.

Descriptors: Reviews, Publications, *Water resources, Documentation, *Bibliographies, Technical writing.

Identifiers: *Current awareness.

Cornell University Water Resources Center has instituted a current awareness service in the water resources area. This service consists of a monthly list of journal articles, books, and reports randomly organized and an annual Permutated Title Index, sometimes called a KWIC (Key Word in Context) index, including the titles which have appeared in the current awareness list. This service provides a convenient and time-saving method of browsing current literature. An alphabetical list of journals regularly searched for water resource related papers is included. This list is limited to sources originally published in the English language or are regularly translated. W69-01138

PSYCHROMETRIC TABLES FOR WYOMING, Wyoming Univ, Laramie.

Paul A. Rechard.

Water Resour Res Inst, Aug 1967. 31 p, 10 tab. OWRR Project A-001-WYO.

Descriptors: *Psychrometrics, *Humidity, *Dew point, Barometric pressures, Meteorology, *Meteorological data, Temperature, Wyoming.

To facilitate the computation of relative humidity and dew points from sling psychrometer readings at the higher elevations experienced in Wyoming, tables of these parameters related to dry-bulb temperatures and wet-bulb depressions are presented for atmospheric pressures of 19, 21, 23, and 25 in. These pressures correspond roughly to elevations of 12,000-, 9,500-, 7,000-, and 4,800-ft MSL. The equations and data for making the computations are included. W69-01159

08. ENGINEERING WORKS

8A. Structures

EMINENT DOMAIN: PUBLIC UTILITIES--CONSTRUCTING DAMS FOR WATER POWER.

State of Florida, Tallahassee.

For primary bibliographic entry see Field 06E.

For abstract, see .

W69-00802

CONSTRUCTION PERMITS FOR DAMS, DIKES, OR LEVEES.

Ohio Laws 1967, Ch H589.

Descriptors: *Legislation, *Ohio, *Dam construction, *Permits, Dams, Dikes, Levees, Administrative agencies, Estimated costs, Engineers estimates, Inspection, Public health, Regulation, Spillways, Water levels, Impoundments, Storage capacity, Judicial decisions.

Identifiers: Attorney General, Injunction.

Field 08—ENGINEERING WORKS

Group 8A—Structures

No dam may be constructed for any purpose, nor shall any dike or levee be constructed for the purpose of diverting or retaining flood water, unless the chief or the chief of the division of water has issued a construction permit. Five categories exist for which such permits are not required. Before a permit may be issued, two copies of the plans and specifications, including a detailed cost estimate, for the proposed construction prepared by a registered professional engineer shall be filed with the chief. The chief shall issue or deny a permit within thirty days from the date of the receipt of the application. The chief may deny a permit if he finds that a dam, dike, or levee built in accordance with the plans and specifications would endanger life, health, or property. The decision of the chief is subject to appeal. The chief or a registered professional engineer must make inspections during construction. If construction is in violation of the permit, the chief may order construction to cease. The attorney general may bring an action for an injunction to enforce an order of the chief. (Smidish-Fla) W69-00849

INSPECTION OF PROJECT WORKS WITH RESPECT TO SAFETY OF STRUCTURES - SETTLEMENTS INVOLVING HEADWATERS - RELICENSING OF PROJECTS.

18 CFR 12.1-12.6, 13.1, 16.1-16.5 (1968).

Descriptors: *Federal Power Act, Projects, *Dams, *Inspection, Storage capacity, Settlement, Movement, Erosion, Seepage, Contracts, Stress, Hydrostatic pressure, Leakage, Administrative agencies, Regulations.

Identifiers: Federal Power Commission, *Non-federal power developers.

Dams exceeding 35 feet in height with a storage capacity of 2000 acres feet which are licensed under Part 1 of the Federal Power Act must be inspected every 5 years. This inspection is of settlement, movement, erosion, seepage, leakage, cracking, stress, and hydrostatic pressures in structures. When the inspection indicates conditions of concern, the Federal Power Commission shall cause additional inspections. Qualified independent consultants are responsible for the inspections. They must file reports and include their recommendations. The licensee is required to submit a plan of action. Contracts may be entered into by licensees and permittees having headwater improvements and downstream non-federal power developers who receive power benefits. Projects not recaptured by Congress upon the expiration of the license and projects not subject to recapture may be relicensed. The various requirements for relicensing are provided. The inspection requirements have a retroactive effect. (Childs-Fla) W69-00881

RECTANGULAR CUTTHROAT FLOW MEASURING FLUMES,

Utah State Univ, Logan.

Gaylor V. Skogerboe, and M. Leon Hyatt. Proc Amer Soc Civ Eng, J Irrig Drain Div, Vol 93, IR4, Pap 5628, pp 1-13, 1967. 13 p, 9 fig, 1 tab, 7 ref, append. OWRR Project B-006-UTAH.

Descriptors: *Discharge measurement, *Water measurement, *Flumes, Measuring instruments, Hydraulics, Installation, Maintenance, Laboratory tests, Subcritical flow, Open channel flow, Hydraulic structures, Design criteria, Submergence, Discharge coefficients.

Identifiers: *Cutthroat flumes, Submerged flow.

Rectangular cutthroat flumes have been developed, and their roles in water measurement, along with the advantages of their use, are discussed. Dimensions and criteria for constructing cutthroat flumes are given. Differences between free flow and submerged flow conditions are examined, along with the necessary criteria for determining which flow regime exists. The value of the transition submergence is listed for each of the

rectangular cutthroat flumes investigated. The free flow analysis and tables are presented for the cutthroat flumes studied, as are the 3-dimensional calibration curves used when the submerged flow exists in the flumes. Examples illustrating free and submerged flow operation are included. Proper installation and maintenance procedures for cutthroat flumes are described, as well as techniques for measuring flow depth which will yield satisfactory results.
W69-01146

MEMORANDUM REPORT ON TEST DRILLING AT NORFOLK VIRGINIA,
U S Geol Surv, WRD, Richmond, Virginia.
For primary bibliographic entry see Field 04B.
For abstract, see .
W69-01175

8B. Hydraulics

ANALYSIS OF SUBMERGENCE IN FLOW MEASURING FLUMES,
Utah State Univ., Logan, Eng Dept.
Gaylor V. Skogerboe, and M. Leon Hyatt.
Tour of Hydraulics Div, Proc Amer Soc Civ Eng, Vol 93, No HY4, Pap 4348, pp 183-200, July 1967. 18 p, 15 fig, 12 ref, append. OWRR Project B-006-Utah.

Descriptors: Open channel flow, *Water measurement, Hydraulics, *Flow measurement, Hydraulic structures, *Flumes, Roughness, Critical depth, *Subcritical flow, Laboratory tests, Measuring instruments, Control structures, *Submergence, Parshall flumes.

Identifiers: *Submerged flow, Boundary conditions, Free flow, Trapezoidal flumes.

The calibration curves which describe submergence in flow-measuring flumes are developed by a combination of dimensional analysis and empiricism. The parameters developed in this manner are further verified by the theoretical submerged flow equation developed from momentum relationships. A flat-bottomed rectangular measuring flume was used to generate data necessary for establishing the parameters describing submerged flow. The resulting form of the discharge equation has been verified for a trapezoidal flat-bottomed flume and a Parshall flume. For any particular flume geometry, both the free flow and submerged flow equations can be placed on a single graph.
W69-00989

8C. Hydraulic Machinery

UNION ELEC CO V FPC (CONSTRUCTION OF POWER PLANT ON NON-NAVIGABLE STREAM).

326 F 2d 535-554 (8 Cir 1964).

Descriptors: *Federal Power Act, Missouri, *Hydroelectric project licensing, *Hydroelectric plants, Federal jurisdiction, State jurisdiction, Sluice gates, Spillway crests, River flow, Navigable waters, non-navigable waters, Hydroelectric power, Transmission (Electric), Pumped storage, Judicial decisions, Interstate rivers, Turbines.
Identifiers: Black River, Federal Power Commission.

The Federal Power Commission held that the Union Electric Company would have to procure a license for construction of a high head pumped-storage electric generating station on the East Fork of the Black River in Missouri. Power is generated by water flowing into a lower pool. The water then is pumped back into an upper reservoir for re-use. The Federal Power Act provides for said license if the Commission finds that any construction project in any non-navigable stream affects interstate or foreign commerce. The court held that the Commission ruling was an order subject to review. The

Commission found that the interests of interstate commerce would be affected because the navigability of the Black River was affected. This finding and order were set aside because there was not substantial evidence to support them. Based on an 18-year record of flows the station could only adversely affect the flow one-half of 1 percent of the time and this would only occur if certain circumstances, such as malfunction, occurred. That the electricity produced would be transmitted interstate has no bearing on the licensing statute. McDermott-Fla) W69-00852

OPTIMIZATION OF A NUCLEAR POWER PLANT BY HYBRID COMPUTER,
Electronic Associates, Inc., Princeton, N. J.
Joseph J. Kovacs.
Comput Automat, Vol 17, No 7, pp 26-31, July 1968. 6 p, 5 fig, append.

Descriptors: *Computers, Analog computers, Digital computers, Optimum use, *Computer programming, Economics, *Nuclear powerplants, Simulation, Control systems, Costs, Data collection systems, Data reduction, Systems analysis, Automation, Mathematical analysis, *Operations research, Data transmission systems, Solutions, Models, Power system operations.
Identifiers: *Analog-digital computers, Problem solving, Procedures, *Optimization, Variables.

The operation of a nuclear powerplant was studied using the Electronic Associates, Inc 8900 Hybrid Computer System. The purpose was to determine the most economical way to simulate kinetic behavior of a nuclear power station and related control system. Ordinary digital methods of calculating such a complicated control system are uneconomical and impractical because over 400 days of continuous computer time would be required. The subject of this study and the computational technique are unusual. The objectives that led to the use of a hybrid computer facility and the physical system used are described. The programming techniques that resulted in the computer model of the powerplant are outlined. The economy and fast result-yielding capability of the hybrid approach are demonstrated as follows: (1) the 10 times faster-than-real-time speed of the hybrid model gives speed advantage over the digital approach by a factor of 200; (2) the economic advantage of the hybrid over the digital approach is 400 to 1; and (3) the economic advantage of the hybrid over the pure analog approach is 50 to 1.
W69-00911

THE OPTIMIZATION OF LARGE SCALE WATER RESOURCE SYSTEMS: OPERATIONAL ASPECTS, PART 1: CONCEPTUAL FRAMEWORK,
California Univ., Los Angeles.

For primary bibliographic entry see Field 06A.
For abstract, see .
W69-00961

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

MANPOWER AND TRAINING NEEDS IN WATER POLLUTION CONTROL.

U S Congr, 90th Congr, 1st Sess, Doc 49, Aug 1967. 50 p, 3 tab, 3 append.

Descriptors: *Manpower, *Training, *Water pollution control, *Water quality control.

The need for trained personnel in the clean water field has become particularly demanding in recent years. The construction rates of both municipal and industrial waste treatment plants have been accelerated. Treatment plants have grown larger and

MANPOWER, GRANTS AND FACILITIES—Field 09

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more complex and require more highly trained operating staffs. In recognition of this problem, the Congress has directed that a national study be made of trained manpower needs and training resources. This report has been prepared in response to this congressional directive.
W69-01124

9B. Education (In-House)

THE CHANGING ROLE OF THE FEDERAL CAREER EXECUTIVE,

Bureau of the Budget, Washington, D. C.
Roger W. Jones.

Civ Serv J, Vol 8, No 4, pp 15-20, Apr-June 1968.
6 p.

Descriptors: *Administration, History, Values, Responsibilities, *United States Government, Population, Planning, Training, Leadership, *Civil service, Psychology, Economics, Decision making, Communications, Social values, Public services, Social sciences, Manpower.

Identifiers: *Executives, *Federal agencies, State governments, Social aspects, Management planning, Cooperation, Local governments.

Federal career administrators are responsible for studying our Federal system of government to find ways to meet the needs of the people and the times, and to find means for accomplishing this within the framework of Federal and state constitutions and laws. Career managers must aid political executives in building a Federal system that is people-oriented and capable of dealing with the growing complexity and interdependence of all segments of our society. Since these problems often are not nationwide, decentralization of Federal agencies and cooperation with state and local governments, agencies, and nongovernmental entities are essential. The Federal career executive must devise coordinated and interlocking activities to solve deep-rooted social and economic problems, and become actively concerned with the politics of programs and policies without partisanship. He must relate his responsibilities to the public good by studying values and providing continuity and historical perspective to his programs. His role is to get work done, decisions made, and policies carried into effect through the management and leadership of people, ideas, and resources. He must use new technologies and advances, computer sciences, behavioral sciences, social sciences including economics, and communications.
W69-00958

9D. Grants, Contracts, AND Research Act Allotments

OFFICE OF WATER RESOURCES RESEARCH, DEPARTMENT OF THE INTERIOR.

For primary bibliographic entry see Field 06E.
For abstract, see .
W69-00775

FOURTH ANNUAL REPORT - FISCAL YEAR 1967-68.

Clemson University, Clemson, S. C.

Water Resources Research Institute, Clemson University, Fourth Annual Report Fiscal Year 1967-68, 81 p, July 1968, 17 ref.

Descriptors: *Research, *Projects, *South Carolina, *Training, *Education.

SUMMARIES OF RESEARCH PERFORMED DURING THE YEAR 1967-68 UNDER EACH OF TEN ALLOTMENT PROJECTS AND FOUR MATCHING GRANT PROJECTS ARE PRESENTED. WORK REMAINING TO BE ACCOMPLISHED IS INCLUDED ON FIVE NEW ALLOTMENT PROJECTS AND ONE NEW MATCHING GRANT PROJECT. ONE OR MORE PROJECTS CONTRIBUTE TO OVERALL RESEARCH ON THE NATURE OF WATER, THE WATER

CYCLE, WATER QUALITY MANAGEMENT AND PROTECTION, WATER RESOURCES PLANNING AND ENGINEERING WORKS. THE PORTION OF THE REPORT ON TRAINING AND EDUCATION GIVES STATISTICS ON NEW STAFF AND FACILITIES, INTER-DISCIPLINARY ARRANGEMENTS AND STUDENT ENROLLMENT IN WATER RESOURCES. REPORT OF INVOLVEMENT OF THE INSTITUTE IN PUBLIC AFFAIRS IS EMPHASIZED THROUGH RESEARCH, SPONSORSHIP OF A CONFERENCE, AND PARTICIPATION BY INDIVIDUALS IN SUCH ACTIVITIES AS THE GOVERNOR'S ADVISORY COMMITTEE, STATE AGENCIES, AND STATE BOARDS. (SNELL-CLEMSON)
W69-00808

ANNUAL REPORT FISCAL YEAR 1968 WATER RESEARCH INSTITUTE, West Virginia Univ, Morgantown, Water Research Inst.

Chester L. Dodson.
Annual Repts, FY 1968, 1968, 69 p.

Descriptors: *West Virginia, *Education, Training, Water resources, Acid mine water, *Water quality, *Environmental effects, Project purposes, Small watersheds, Fisheries, Fish management, Conservation, Management, Water law, Legislation, Publications, Research and development, Runoff, Project benefits, Standards, Waste treatment, Sediments, Iron, Clays.

Identifiers: *Annual report, Education and training, Project progress, *Water research institute, *Water research, Water-quality standards.

This is a routine annual report. It reports on progress made for 17 projects: 10 biologic, 4 hydrologic, and 3 geochemical. Most of them are related to acid mine water or water quality. Biologic projects involve study of environmental effects and seeking new methods for waste treatment. Hydrologic projects include small-watershed and precipitation-distribution studies. Geochemical projects involve sediment in reservoirs and water in flooded mineshafts. Results will be used in planning water-quality standards, sports fisheries, runoff-and-precipitation analyses, and additional research. Some unpublished results are now usable. Some results will be published in FY 1969. Education and training data show a numerical relationship of this field to research. The Director and members of the Institute participate in representative public meetings to gain knowledge needed to plan research related to 'real life' conditions and to disseminate information to the meeting attendees. The Institute is working with a legislative committee studying West Virginia water-law needs.
(Author)
W69-00859

ANNUAL REPORT OF ACTIVITIES FOR FISCAL YEAR 1968 WATER RESOURCES CENTER, UNIVERSITY OF MAINE, Maine Univ, Orono, Maine.

W. Viessman, Jr.
Annual Report of Activities for Fiscal Year 1968 Water Resources Center, University of Maine, Publication No. 4, June 1968, 38 pp, 2 append, disc.

Descriptors: Water resources, Water quality, Hydrology, Soil moisture, Watershed management.
Identifiers: Water resources research, Maine water problems.

A DISCUSSION OF THE ACCOMPLISHMENTS OF THE MAINE WATER RESOURCES CENTER FOR FISCAL YEAR 1968. INVOLVEMENT OF THE CENTER IN RESEARCH, EDUCATION AND TRAINING, AND COORDINATION OF VARIOUS WATER RESOURCES ACTIVITIES IS OUTLINED. INDIVIDUAL RESEARCH REPORTS ON CONTINUING PROJECTS ARE INCLUDED.
(Author)
W69-00909

ANNUAL REPORT TO OFFICE OF WATER RESOURCES RESEARCH FOR FISCAL YEAR ENDING JUNE 30, 1968, Minnesota Univ, St. Paul, Minn.

William C. Walton.

MINNESOTA WATER RESOURCES RESEARCH CENTER, MimeoGRAPHED REPORT, AUGUST 1968. 96 p, 3 fig, 30 tab, 10 ref.

Descriptors: *Water Resources Research, *Minnesota Water Resources Research Center, *Fiscal Year 1968 Annual Report.

THE UNIVERSITY OF MINNESOTA ESTABLISHED ON SEPTEMBER 1, 1964, IN THE GRADUATE SCHOOL AN INTER-DISCIPLINARY WATER RESOURCES RESEARCH CENTER. THE CENTER HAS RESPONSIBILITY FOR UNIFYING AND STIMULATING UNIVERSITY WATER RESOURCES RESEARCH THROUGH THE ADMINISTRATION OF FUNDS ASSOCIATED WITH THE WATER RESOURCES RESEARCH ACT AND MADE AVAILABLE BY OTHER SOURCES AND ASSISTING IN TRAINING ADDITIONAL SCIENTISTS FOR WORK IN THE FIELD OF WATER RESOURCES THROUGH RESEARCH. THE CENTER FINANCED 14 RESEARCH PROJECTS INVOLVING 11 FACULTY MEMBERS DURING FISCAL YEAR 1968. THESE RESEARCH PROJECTS WERE CONCERNED WITH POHOLE DRAINAGE AND GROUND-WATER RESOURCES, MOVEMENT OF WATER THROUGH SOILS, OVERFERTILIZATION OF LAKES AND STREAMS, SURFACE WATER RUNOFF, WATER LAW IN MINNESOTA, AND WATER QUALITY MANAGEMENT. DURING THE 1966-67 ACADEMIC YEAR, THERE WERE 35 SENIORS, 38 MASTER'S DEGREE STUDENTS, AND 26 DOCTORAL STUDENTS USING EQUIPMENT AND SUPPLIES PURCHASED WHOLLY OR IN PART BY THE CENTER. ABOUT 45 STUDENTS RECEIVED EMPLOYMENT AS RESEARCH ASSISTANTS THROUGH THE CENTER'S PROGRAM.
(Author)
W69-00910

INSTITUTE OF WATER RESEARCH ANNUAL REPORT FOR 1967-1968, Michigan State Univ, Lansing, Water Resources Research Institute.

Robert C. Ball, and Niles R. Kevern.
Annual Report for 1967-1968 of Water Resources Research Sponsored under Public Law 88-379 in Michigan, 1968.

Descriptors: Allotments, Training, Farm ponds, Hydrogeology, Geologic mapping, Glaciers, Pesticide residues, Tertiary treatment, Adsorption, Limnology, Forest soils, Soil disposal fields, Nitrates, Phosphates, Watershed management.

Identifiers: Michigan.

THE REPORT INCLUDES BRIEF DESCRIPTIONS OF ELEVEN ALLOTMENT GRANT PROJECTS AND THREE MATCHING GRANT PROJECTS FUNDED UNDER PUBLIC LAW 88-379. THERE WERE FIVE ALLOTMENT PROJECTS IN ENGINEERING ON WASTE WATER HANDLING AND TREATMENT, FOUR IN BIOLOGY ON LIMNOLOGICAL ASPECTS OF POLLUTION, ONE IN GEOLOGY ON GROUNDWATER, AND ONE IN HYDROLOGY CONCERNED WITH PROPERTIES OF FOREST SOILS. ALL MATCHING GRANTS WERE IN GEOLOGY, ONE ON GLACIOLOGY AND TWO ON GROUNDWATER RESEARCH. THE INSTITUTE IN MICHIGAN ADVISED ON THE DEVELOPMENT OF TWO NEW WATERSHED COUNCILS, COOPERATED WITH AN EXISTING COUNCIL ON STREAM MONITORING, AND SERVED IN AN ADVISORY CAPACITY TO STATE AND FEDERAL AGENCIES ON TOPICS OF WATER QUALITY STANDARDS, PESTICIDE PROBLEMS, POLLUTION, AND WATER RESOURCES RESEARCH PROGRAMS. INTEREST IN WATER RESOURCES RESEARCH WAS STIMULATED THROUGH SEMINARS, DEVELOPMENT OF NEW COURSES, AND MEETINGS OF CAMPUS RESEARCH LEADERS. THE REPORT INCLUDES A SUMMARY OF THE SCOPE OF COLLEGE TRAINING OF WATER RESOURCES MAJORS AT FOUR MICHIGAN UNIVERSITIES. (KEVERN-MICH STATE)
W69-00960

ANNUAL PROGRAM REPORT, FISCAL YEAR 1968 PUBLICATION AUGUST 15, 1968, Missouri Univ, Columbia, Missouri Water Resources Research Center.

George E. Smith.
Water Resources Research Center.

Descriptors: *Water Resources Research Act, *Missouri, Karst, Evapotranspiration, Flow, Legislation, Trace elements, Vibrations, Ecology, Chemistry, Groundwater, Roughness, Irrigation efficiency, Mine wastes, Sewage lagoons, Sediment transport, Water districts, Mine drainage, Soil permeability.

Identifiers: *Annual reports.

Field 09—MANPOWER, GRANTS AND FACILITIES

Group 9D—Grants, Contracts, and Research Act Allotments

Contains progress reports on 16 water resources research projects and planned studies on 12 new investigations. Included are studies of effects of ultrasonic vibrations on aerated biological systems; chemistry of water and improved chemical methods for trace amounts of ions in water; alternatives for water resources regulations, methods for measuring stream flow, ecology in waste assimilation by streams; trace element studies in the Missouri River; stream pollution in the 'Lead Belt', environmental factors in multi-purpose reservoirs; water penetration and storage in selected areas; analysis of public water supply districts; transport of sediment; separation of suspended solids, and sorption of chlorinated hydrocarbons by clay minerals. Information is included on the training of students in water science. Reports are given on participation in short courses and conferences pertaining to water resources. Also listed are activities of the Water Resources Research Center in contributing to public and academic affairs and for the promotion of improved water conservation and management. (Author)

W69-00980

INVENTORY OF RESEARCH IN WATER POLLUTION AND RELATED FIELDS: COLUMBIA BASIN AND PACIFIC COAST STATES.

Federal Water Pollution Control Administration, Corvallis, Oreg.

Lyman J. Nielson.

Fed Water Pollut Contr Admin Rep, Nov 1966. 135 p. Pub Health Serv-FWPCA Project 1263.

Descriptors: *Pacific Coast Region, *Pacific Northwest U.S., Alaska, *Columbia River Basin, Water pollution, California, *Water pollution, Control, Research and development, Hawaii, Idaho, Montana, Washington, Oregon, Wyoming, Utah.

Identifiers: British Columbia, Canada.

This is the seventh inventory of water pollution research for the Columbia River Basin and Pacific Coast States. In addition to the abstract of each research project, this issue provides information relating to distribution of efforts in various areas of water pollution research. Each researcher submitting data for the inventory was asked to indicate the pertinent research area or areas of his project. The data submitted are given in three tables. Table I, Allocation of Financial Resources, provides information on the relative distribution of research funds. Table II is a summary of the source of research funds. Table III provides data on personnel resources. The research summaries are grouped alphabetically by states. Each project has been numbered for indexing. In the research index each project is listed under all pertinent areas. The listing of each research project contains the following basic information as submitted: (1) title of project, (2) name of institution doing research, (3) summary or abstract of project including objectives, (4) date project was started, (5) estimated duration of project, (6) name of principal investigator, (7) number and disciplines of personnel on project, (8) equipment used, and (9) pertinent publications.

W69-01125

FISCAL 1968 ANNUAL REPORT OF THE WATER RESOURCES CENTER,

Pennsylvania State Univ., University Park, Pa.

John C. Frey, and E. Bruce Jones.

Institute for Research on Land and Water Resources, Information Report No. 56, University Park, Pa., Aug. 1968. 178 p, 5 append.

Descriptors: Acid streams, Eutrophication, Water pollution, Waste water disposal, Carbonates, Hydrogeology, Watershed management, Water pollution sources, Phosphates, Escherichia coli, Sewage effluents, Aquatic microbiology, Demand, Supply, *Training, *Universities, Grants, *Education, Allotments, Pennsylvania.

Twenty OWRR projects have been conducted during the 1967-68 Fiscal Year at the Water Resources Center of the Institute for Research on

Land and Water Resources. The research projects concerned the neutralization of acid streams, stream eutrophication, stream pollution, waste water renovation, carbonate hydrogeologic environments, watersheds, numerical simulation of groundwater flow systems, phosphate removal from water, simplification of integrated stormwater planning, significance of Escherichia coli serotypes in sewage effluent and water supplies, and water demand-supply analyses. A 'Training and Education' section includes the names, degrees, and departments of students who have assisted the principal investigators of OWRR projects during some phase of their research. A listing of the public activities of the directors of the Institute and the principal investigators of OWRR projects during Fiscal Year 1967-68 is also included. These activities are listed under 'Meetings and Seminars,' 'Committees and Special Appointments,' and 'Public Law' headings. (Sink-Pa State)

W69-01194

1968 ANNUAL REPORT - WRRI - UNC, 34 pp, July 1968,

North Carolina State Univ, Raleigh, N.C.

David H. Howells.

Water Resources Research Institute, Raleigh, N.C.

Descriptors: *Water Resources Research Act, Allotments, Grants, Training, Universities.

Identifiers: Flood routing, Currents (Water), Pesticide residues, Methodology, Model studies, Eutrophication, Economic impact, Planning, Environmental effects.

Principal thrust was to expand research program with major new commitments for FY 1969 by the Raleigh and Chapel Hill campuses. The FY 1968 annual allotment was supplemented by \$20,000 in University funds and additional \$38,000 in services and facilities. Projects scheduled for completion in FY 1968: Routing of Flow in Streams in N. C.; Diffusion and Dispersion in Porous Media; Movement of Water in N. C. Soils and Effect on Water Quality; Ecology, Present and Alternative Future Land Use Patterns in Dismal Swamp; Current Study of Neuse River and Estuary; Oxygenation of Iron (II) in Continuous Reactors; Lake-Oriented Residential Subdivisions; Simulation of Regional Economic Impacts of Water Resources Development; Pigment Indices of Environmental Oxygen Stress. Projects continuing: Inventory of Water Resources in N. C.; Design of Monitoring System for Pesticides; Computer Simulation of Aquifers. Matching Grant projects: Exchange of Phosphorus Species Between Living and Nonliving Systems; Changes During Eutrophication of an Estuary. A graduate minor in water resources was offered for the first time. Six seminars were presented. Institute faculty were active in public affairs relative to water resources planning and management. The Institute Newsletter continued as the primary means of communication with public. (Author)

W69-01195

KANSAS WATER RESOURCES RESEARCH INSTITUTE ANNUAL REPORT FOR FISCAL YEAR 1968,

Kansas State University, Manhattan, Kansas.

Hyde S. Jacobs.

Kansas Water Resources Research Institute.

Descriptors: Evapotranspiration, Microclimatology, Regimen, Pesticides, Animal wastes, Fertilizers, Aerobic treatment, Groundwater movement, Dispersion.

The report contains brief summaries on institute involvement in public affairs, region approaches to water resources research, institute involvement in academic affairs, significant technical accomplishments, expected results from incomplete projects, publications resulting from the institute's research, and brief narrative reports on the ongoing research. Technical accomplishments on such research as: animal feedlot pollution, nitrate removal from potable water, activity patterns of fish exposed to

toxic materials, step aeration waste treatment systems, water contamination by pesticides, nitrate accumulation in groundwater and numerical modeling of groundwater flow are discussed. A summary of expected results on inorganic material removal, weather modification, microclimatology, evapotranspiration reduction, moisture use by wheat, longitudinal dispersion in river basins, groundwater recharge, river course and regimen, nitrate accumulation in water, pesticide contamination of water, feedlot pollution and aeration waste treatment systems is also included. Budgets for all matching grant and allotment grant projects as well as an over all budget summary are given. (Powers-Kansas State)

W69-01196

FOURTH ANNUAL REPORT, UNIVERSITY OF IDAHO. WATER RESOURCES RESEARCH INSTITUTE,

Idaho Univ., Moscow.

C. C. Warnick.

Annual Report - Water Resources Research Institute - Idaho, Volume 4, 79 p.

Descriptors: Literature, Education, Research Act Allotments.

Identifiers: Reports, Annual.

A resume of activity on 10 Allotment type research projects and one Matching Grant project was summarized. Three projects were completed including a study on movement of water from canals to the groundwater reservoir, a microclimate study of a transection across a river valley, and a study of indices for classifying chemicals which affect water quality for aquatic life. The Institute also assisted in initiating four separate water related studies in the University with the Idaho Water Resource Board. On one of these the Institute completed a two volume Water Inventory for Idaho. Ten graduate students were actively engaged in research projects supported by Office of Water Resources Research funding. (Author)

W69-01197

ANNUAL REPORT FOR FISCAL YEAR 1968,

South Dakota State Univ., Brookings, South Dakota. Water Resources Institute.

John L. Wiersma.

South Dakota Water Resources Institute, No. 3, Aug 1968. 121 p.

Descriptors: *Training, Agriculture, Animal wastes, *South Dakota, Computer models, Construction, Conservation, *Energy budget, Evapotranspiration, Microclimatology, Sprinkler irrigation, *Water quality, Irrigation, Hydrographs, Sinks, Synthesis, Spring, Salinity, Groundwater movement, Waste disposal, Permeability, Oxidation lagoons.

Identifiers: *Report, *Public affairs, Biocides, Economic potential, Information retrieval, Resources inventory, Primary production.

The Water Resources Institute supported fourteen active research projects with emphasis placed on water supply augmentation and conservation in agriculture. The developing irrigated agriculture as well as the predominate dryland agriculture received attention. Water resources planning received special attention including an evaluation of the potential contribution of water resource development in light of the Missouri River Basin development. Irrigation, as well as effect of large water impoundments have received attention. A predictive model is being tested. Water quality management and protection was studied in the light of potential groundwater contamination from urban refuse disposal as well as agricultural pollution to surface waters including the determination of the levels of chemical biocides in the ecosystem of a prairie lake. The water retention characteristics of waste water stabilization ponds was studied with results dictating revised design standards. The program involved 230 students of which 125 graduated with 33 being employed by the Institute.

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9 disciplines with 6 new courses and 8 new staff members were represented. The Institute is becoming involved in public affairs through conferences and committees. (Author) W69-01198

ANNUAL REPORT OF THE ARKANSAS WATER RESOURCES RESEARCH CENTER FOR FY68, Arkansas Univ., Fayetteville. Arkansas Water Resources Research Center.

Aubrey E. Harvey.

Ark WRRC Annual Reports, 4th, Sept 1968, 241 p, 26 fig, 14 tab, 107 ref, 2 append.

Descriptors: *Subsurface irrigation, Automation, Thermal pollution, *On-site data collections, *Trace elements, Impoundments, Fertilizers, Pesticide residues, Interstate commissions, Viruses, Sedimentation, Groundwater, *Parasitism, *Water allocation (Policy), *Aquatic productivity, Eutrophication, Telemetry, Planning, Filtration.

10 project reports; FCST category IIK trace elements in impoundments 34 pp 7 fig 3 tab; IIIIF automated subirrigation 8 pp 1 tab; IVB sedimentation and filtration in groundwater treatment 6 pp 2 fig; VB fertilizer-pesticide reaction in re soil water quality 4 pp, virus movement in groundwater 2 pp; VID water resources planning studies for Ark-Oklahoma compact 5 pp; VIIIG environmental changes in coldwater outlets from reservoirs 4 pp, water diversion effect on biota and water quality 56 pp 10 fig 4 tab; impoundment effect on water quality as reflected in bass parasitism 24 pp 4 fig 1 tab; VIIIB telemetry for digital on-site water data collection 50 pp 3 fig. Center report contains information water related education and training at Univ of Ark and Ouachita Baptist Univ. Involvement in public affairs: representation on Governor's Coordinating Committee on Water Resources and State Committee on Stream Preservation, consulting on problems of thermal pollution in nuclear power generation, addresses to civic clubs and wildlife groups. Lists 3 publications and 5 theses resulting from projects.

W69-01199

ANNUAL REPORT - NEW JERSEY WATER RESOURCES RESEARCH INSTITUTE - 1967-1968,

Rutgers - the State University, New Brunswick.

William Whipple, Jr.

New Jersey Water Resources Research Institute 74 p, 6 illus, 2 tab.

Descriptors: Research grants, Research facilities, Water resources development, Economics, Urbanization, Biochemical oxygen demand, Dissolved oxygen.

Identifiers: Water resources research administration, Oxygen dynamics of streams, Metropolitan area water resources, Artificial river aeration.

A report on research and training activities of the New Jersey Water Resources Research Institute during fiscal year 1967-68 under provisions of P.L. 88-379. Includes mainly activities at Rutgers - the State University of New Jersey, with participation in specific projects by Princeton University and Stevens Institute. Research involved was funded mainly by the Office of Water Resources Research, but also by the Federal Water Pollution Control Administration, New Jersey State Department of Conservation and Economic Development, New Jersey State Department of Public Health, and the Delaware River Basin Commission. The program emphasizes three main fields of activity: (1) Oxygen dynamics and biochemical oxygen demand of streams, (2) metropolitan area water problems, and (3) economics of water resources. (Author)

W69-01200

FOURTH ANNUAL REPORT OF THE ARIZONA WATER RESOURCES RESEARCH CENTER, Arizona Univ, Tucson.

Water Resources Research Center, The University of Arizona, Tucson, Arizona 85720. 57 p, August, 1968.

Descriptors: *Annual Report, Research, Education, Training, OWRR Programs.

Identifiers: *Arizona, *Water Resources Research Center, Annual Report FY '68.

The publication contains a brief summary of the research projects conducted in Arizona through the Water Resource Research Center. A financial summary of each project is included. New personnel and new courses of the Hydrology and Water Resources Program at The University of Arizona are listed. Research Projects summarized include studies of Gravity and Magnetic Surveys for Water Explorations, Soil-Water-Plant System Analysis, Salinity Effects on Plants, Social and Economic Studies of Water Use, Operations Research Methods Applied to Water Management, Soil Treatments to Increase Runoff, and a study of Trace and Tracer Elements in Ground Water.

W69-01201

ANNUAL REPORT, WATER RESOURCES RESEARCH ACTIVITIES UNDER PUBLIC LAW 88-379, FISCAL YEAR 1968, GEORGIA INSTITUTE OF TECHNOLOGY.

Georgia Institute of Technology, Atlanta, Georgia.

Water Resources Center, Georgia Institute of Technology, WRC-0368, August 1968. 108 p, 4 photos, 6 tab.

Descriptors: Ion exchange, Oxygen (Balance), Impoundment limnology, Piezometric surfaces, Cation adsorption, Phosphorous, Polarographic analysis, Hydrologic budget, Heavy metals, Aquatic ecosystems, Georgia water law, Ground water movement, Textiles, Stratified flow, Radioactive wastes, Manganese, Attitudes, Metropolitan planning, Water users.

Identifiers: Georgia, University of Georgia, Georgia Institute of Technology, Water resources research activities.

Progress on 24 projects in the research program active during FY 1968 and activity expected on 10 projects to be initiated in FY 1969 is outlined. Significant accomplishments to date and accomplishments anticipated for these projects are discussed. Three of the projects in the program deal with the nature of water; 8 of the projects are concerned with the water cycle, covering the hydrologic cycle, including water and plants, erosion and sedimentation, chemical processes, and estuarine problems; 2 are in the field of water quantity management and control; 8 deal with water quality management and protection; 10 are concerned with water resources planning, a good example of which is 'Interrelations between River Basin Developments and Development of Metropolitan Areas'; 1 involves the development of a method of determining and mapping the hydrologic response of ungaged watersheds in the Southeast; and 2 are in the field of engineering works. Information on student involvement and the training and educational aspects of the research program at both Georgia Tech and the University of Georgia is included. Involvement in professional, public service, and academic activities of personnel at Georgia Tech and the University of Georgia who are associated with the PL 88-379 research program is discussed.

W69-01202

ANNUAL REPORT 1967-1968. Hawaii Univ, Honolulu.

Ann Rpt 67-68, Sept 1968. 126 p, 24 fig.

Descriptors: Hawaii, Floods, Hydrogeology, Aquifer characteristics, Geophysical exploration, Well logging, Ground-water tides, Ground-water recharge, Ground-water pollution, Water color, Tracers, Estuarine pollution, Hydrologic data, Irrigation, Evapotranspiration, Water values.

Annual progress report on the research program of the University of Hawaii Water Resources Research Center: the work reported includes studies of floods in small watersheds, aspects of the geohydrology of certain areas on Oahu, Maui, and Hawaii, surface geophysical exploration for ground water and geophysical well logging, tidal oscillations in ground water, identification of ground-water pollution effects, the pollution of certain estuaries, the removal of color from surface water, water tracing and dating, the design of hydrologic data network, the water use of sugar cane, and the value of water for irrigating sugar cane. (D. C. Cox-Hawaii).

W69-01203

FOURTH ANNUAL REPORT. PURDUE UNIVERSITY WATER RESOURCES RESEARCH CENTER. F.Y. 1968.

Purdue Univ, Lafayette, Indiana.

Dan Wiersma.

Report issued from Center Sept. 1, 1968. 93 p, 9 fig.

Descriptors: *Indiana, *Water Resources Research Act, *Training, Manpower, Allotments, Universities.

Purdue University Water Resources Research Center is supporting projects in watershed hydrology, geomorphology of stream beds and flood plains, classification of streams, statistical analysis of ground-water regimes, infiltration predictions, pesticide persistence in watersheds, urban hydrology, and water resources manpower needs. Some of the results reported included the development of a procedure whereby the runoff from small Indiana watersheds are predicted for any given storm; a statistical analyses of the ground water level regimes in Bartholomew County, Indiana delineating on the map areas of ground water surplus and deficiencies, and that the organophosphate and carbamate pesticide used on the Southern Indiana watersheds did not persist in the pond reservoirs nor in the soil of the watershed. In the latter results there were no effects on those terrestrial and aquatic organisms inventoried both before and after application of the pesticide. The report also contains a summary of the training activities in relation to water resources at the University. It also relates the water Resources Center's involvement in such activities as the State Water Plan, Legislative Advisory Committees, and Interstate Commissions. (Author)

W69-01204

REPORT OF UNIVERSITY OF KENTUCKY WATER RESOURCES INSTITUTE, FY 1968, Kentucky Univ, Lexington, Kentucky.

Robert A. Lauderdale.

Report for FY 1968, Kentucky Water Resrcs Inst, Lexington, 1968, 141 p.

Descriptors: Recreation demand, Flood control, Pesticides, Strip mines, Non-structural alternatives, Water law, Chemical oxidation, Geochemistry, Water chemistry, Aesthetics, Soil water, Capillary water, Acid bacteria, Soil water movement.

During FY 1968 the University of Kentucky Water Resources Institute supported fourteen new or continuing projects under section 100 of P.L. 88-379. The subjects covered include (1) the economic analysis of alternative flood control measures, (2) persistence of pesticides in impounded waters, (3) the economic impact of flood control reservoirs, (4) ecological study of the effects of strip mining on the microbiology of streams, (5) chemistry of the oxidant ferrate, its interaction with specific organics found in waste water, (6) solution

Field 09—MANPOWER, GRANTS AND FACILITIES

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geochemistry of the water of limestone terrains, (7) aesthetic and recreational potential of small naturalistic streams near urban areas, (8) capillary-diffusion and self-diffusion of liquid water in unsaturated soil, (9) evaluation of the legal institutions of diversion, transfer, storage, and distribution of water in Kentucky, (10) a preliminary reconnaissance of areas to be impounded in the Salt River Basin of Kentucky, (indicates completion report available). The annual report includes statistical data on the training and other activities of the Institute during FY 1968. (Author)
W69-01205

10. SCIENTIFIC AND TECHNICAL INFORMATION

AN ANNOTATED BIBLIOGRAPHY OF OBSERVATIONS ON ILLINOIS WATER RESOURCES 1673-1850.
Illinois Univ., Urbana.
Thomas P. Schlunz, Robert M. Sutton, and George W. White.
Final Rep, Water Resour Center, Aug 1967. 77 p.
85 ref. OWRR Project A-017-Ill.

Descriptors: *Bibliographies, History, *Water resources, Natural resources, Evaluation, *Illinois.

This bibliography consists of travel narratives and descriptive accounts of Illinois written by observers who were in the state or who wrote of the state between the years 1673 and 1850. These limits were chosen because the first recorded European set foot on Illinois soil in 1673, and after the middle of the nineteenth century the official state and federal geological reports can be relied upon. The works included in this list were chosen because the authors of them recorded observations bearing on the state of the water resources in Illinois at the time of their visits or publication. The entries in the bibliography consist of the titles, an introductory and summary paragraph, and the pertinent selections from the works. The two criteria in assembling this bibliography were that the work contain matter relating to the water resources of Illinois, and that the work was published and therefore received wide circulation. The bibliography is arranged alphabetically. A chronological list of the works, in the order of the years of observation, when known, or by order of publication, follows

the bibliography.
W69-00975

A STORAGE AND RETRIEVAL SYSTEM FOR THE NEVADA WATER RESOURCES DATA CENTER.

Nevada Univ, Reno.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01118

STORAGE AND RETRIEVAL OF DATA FOR WATER QUALITY CONTROL.

Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01126

PERMUTED TITLE INDEX--1963.

Cornell Univ, Ithaca, N.Y.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-01138

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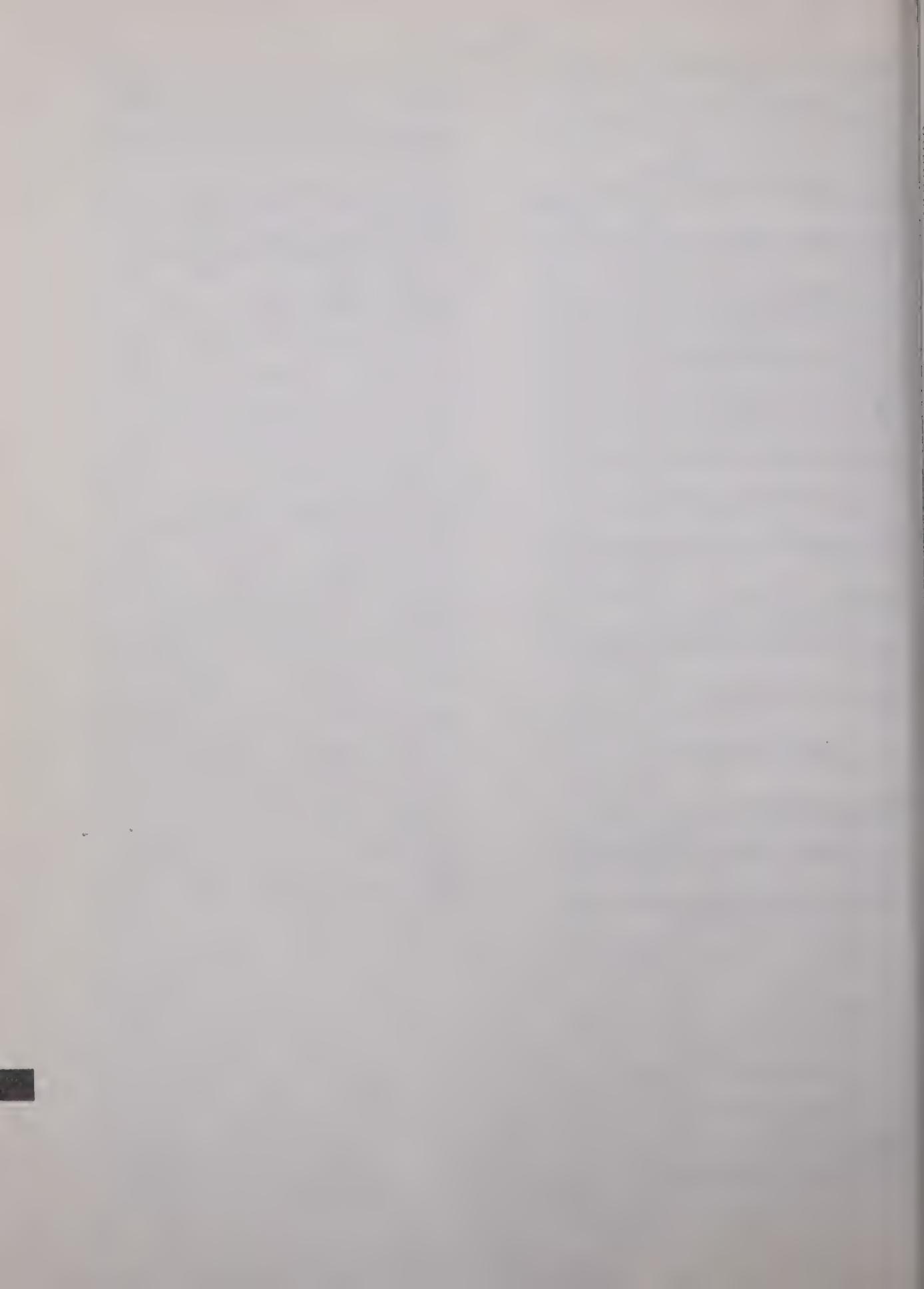
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